APPLIED HYDRAULICS

FEBRUARY 1955

THE MAGAZINE OF
FLUID POWER
INCLUDING AIR CONTROLS
AND AIR CIRCUIT DESIGNS
• ELECTRICAL CONTROLS •

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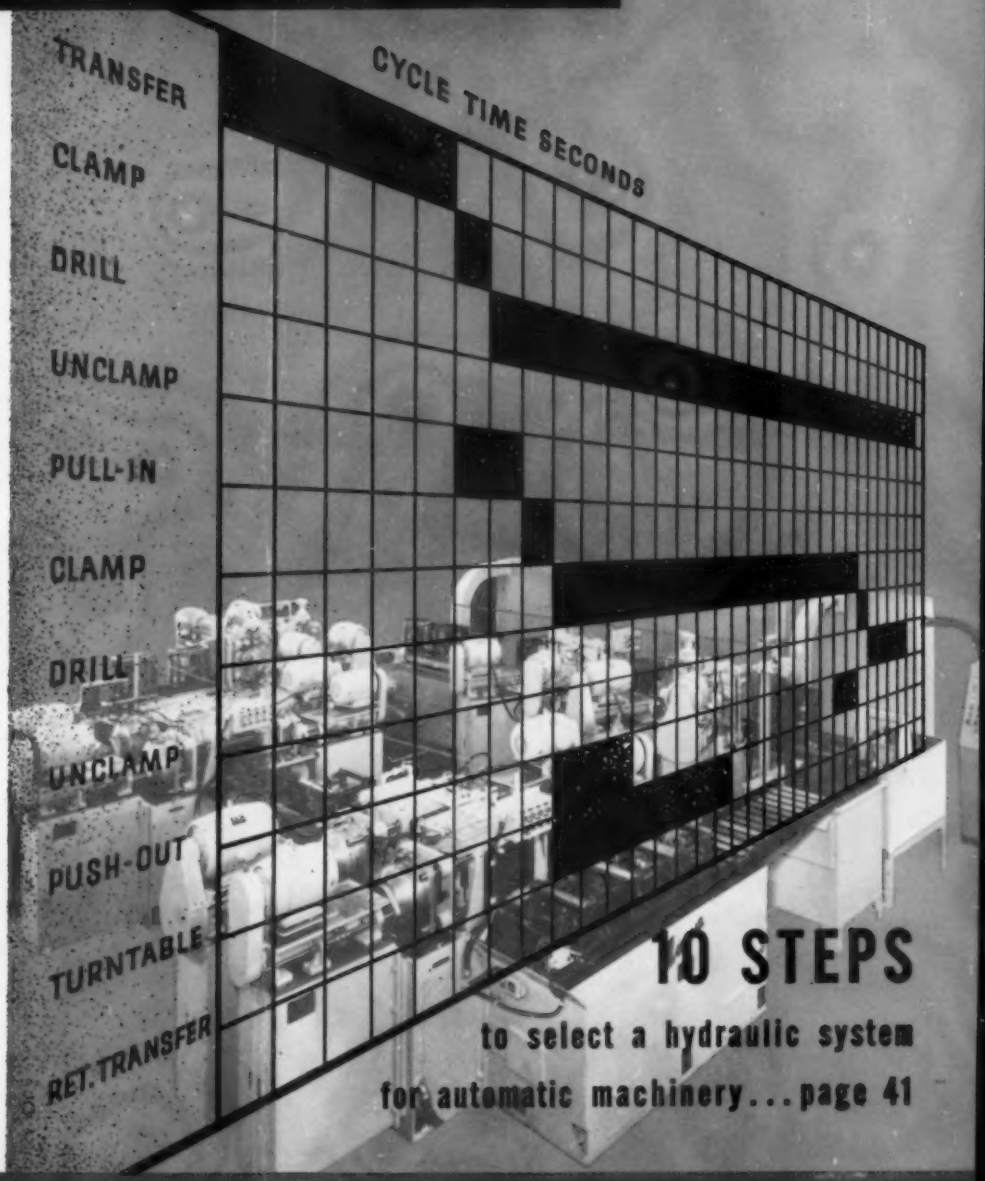
CIRCULATION FRANCHISED



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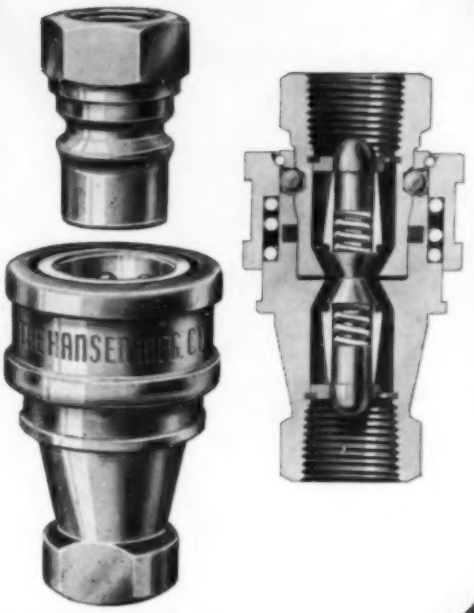
HANSEN

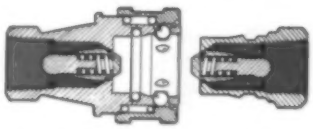
QUICK-CONNECTIVE

2-WAY SHUT-OFF COUPLINGS!



QUICK CONNECTION AND DISCONNECTION

INSTANT AUTOMATIC FLOW OR SHUT-OFF



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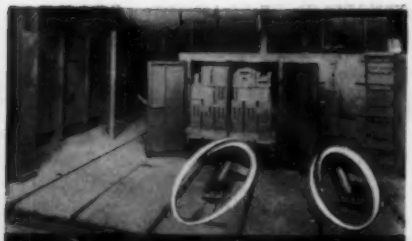
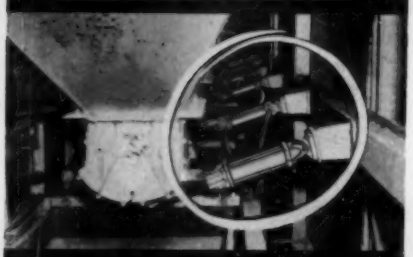
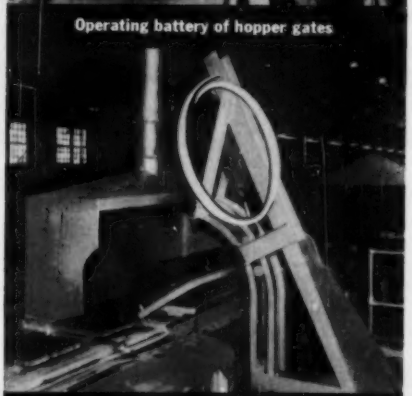


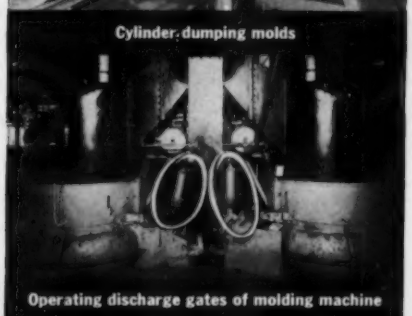
Material movement in and out of ovens



Operating battery of hopper gates



Cylinder dumping molds



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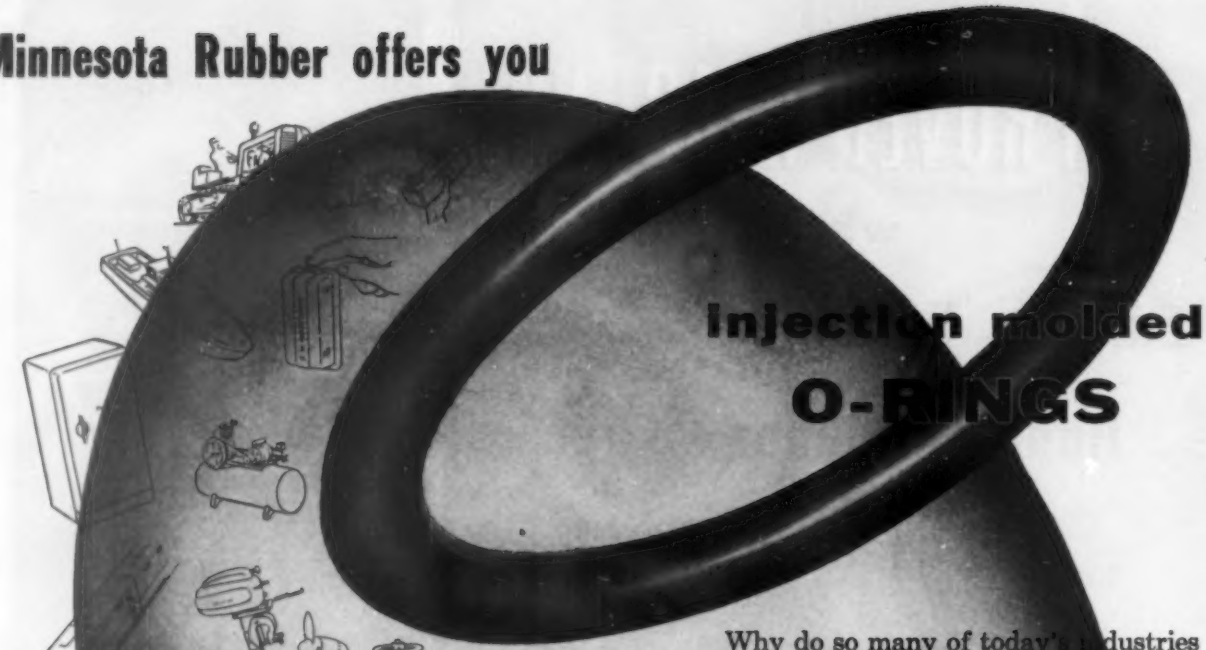

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APPLIED HYDRAULICS

VOLUME 8 NUMBER 2

FEBRUARY 1955

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CHECK HERE

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Alcohol	Edible Oils	Mash	Shortening
Ammonia	Ethane	Methane	Sludge
Beer	Fish Oils	Milk	Soap
Benzol	Formaldehyde	Molasses	Sodium Chloride Solution
Boiler Feed Water	Fresh Water	Naptha	Sodium Silicate
Brewer's Mash	Gas, Manufactured	Nitric Acid	Sodium Sulfate Solution
Butter	Gas, Natural	Nitrogen	Starch
Butane	Gasoline	Oil, Crude	Sulphuric Acid
Cane Syrup	Glucose	Oil, Refined	Sump Water
Calcium Carbonate Slurry	Glue	Oxygen	Sweet Water
Calcium Sulfate Slurry	Glycerine	Paint	Tomato Juice
Casein Solutions	Glycols	Potassium Hydroxide	Varnish
Cement Slurry	Hydrochloric Acid	Propane	Vinegar
Chocolate	Hydrofluoric Acid	Raw Boiler Feed Water	Viscose
CO_2 Gas	Ink	River Water—Dredging Operations	Water (various)
Crude Oil	Jam	Rosin	Wax
Dairy Products	Jelly		Whey
	Ketchup		
	Lacquer		

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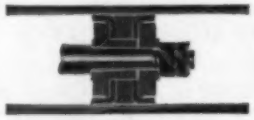
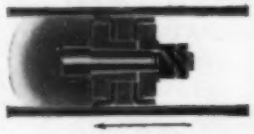
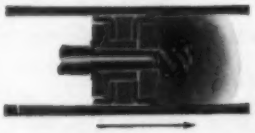
DIAGRAM OF DARCOVA PUMCUP ACTION (greatly exaggerated)



NORMAL: BOTH PUMCUPS RELAXED



UNDER PRESSURE: PUMCUPS SEAL AGAINST CYLINDER DESPITE WEAR, MINIMIZING SLIPPAGE



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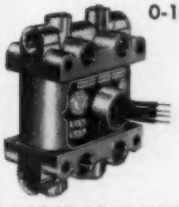

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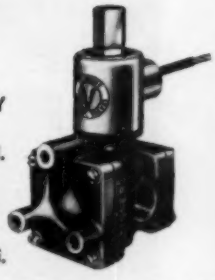

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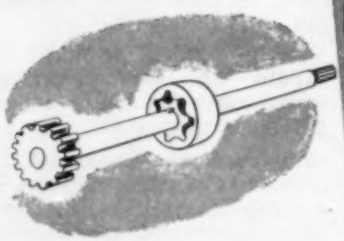

For instance . . . it may be necessary to "wrap" the pump around a "thru" shaft. The unique design of the GEROTOR element (heart of all GEROTOR hydraulic pumps) permits this design feature without sacrifice of space. This is only one example of the many design problem solutions created by GEROTOR engineers.

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SAFEGUARDING INDUSTRY'S Lifelines of Mobile Power

Fluid Power Lines

about Applied Hydraulics

9½ Steps to Design

You'll find that Jim Tankard's article details ten steps to take when selecting a hydraulic system. In the preparation of this article, Jim didn't start by saying, "There are ten steps let's explain them". He first started to put down all the things he has to do before he can order any components. Once he listed all these steps, he combined some, crossed out and revised and altered the sequence many times. It all worked out to a pat 10 step package. Quite honestly we could have changed the number of steps but 10 is nice—some people might frown at 9½ steps.

The article gives you an excellent opportunity to follow a complete circuit selection for a special automatic machine. Much work takes place between the drawing board and a final purchase order for cylinders, valves and pumps.

5000 psi Circuit

If you get into a discussion on the merits of a high pressure hydraulic system, you have to work hard to make a good case. Someone is likely to break up the discussion with the comment: "As long as we have leaks at 500 psi there's no sense in talking high pressures." This comment always draws tremendous support from machine tool men. One almost believes that many designers are happy to have such an excellent reason for resigning themselves to low pressure circuits. With all this resistance against high pressure, it takes a great need, and also requires designers with considerable courage to venture into the high pressure field.

One high pressure, 4000 psi, system is described in this issue by L. R. Hoffman. The machine is an extrusion press—a field in which pressures over 2000 psi are quite common. The circuit is unusual because of its simplicity which has been gained by using fixed displacement high pressure pumps. A price was paid for this simplicity—that price being reduced flexibility as compared to a variable delivery system.

Reprints are available!

Extra copies of "Component Application Sheets", bound as a 32 page booklet are available for $.50 each from APPLIED HYDRAULICS, 1240 Ontario, Cleveland 13, Ohio. If you want 50 to 99 copies, the price is $.40 each. For 100 copies or more, the price is $.35 each.

More Payload

To a designer of mobile equipment, the words MORE PAYLOAD causes a tack-on-the-seat reaction. For several excellent design ideas for increasing payload you'll want to read the article on page 72 by Bill Ranney and Cliff Raymond. They redesigned a circuit on a truck-crane so that only 18 inches of truck length are taken up by the crane.

An Air Idea

Take a look at page 71 and then go out in your shop and see if you can't use the same idea on some of your fixtures. It is a very simple idea and it's probably not too original either. But it can save you a lot of dollars in equipment.

1955 Prize Paper Contest

Each man who requests an Entry Blank, Rules and Suggestions for the 1955 APPLIED HYDRAULICS Prize Paper Contest will also receive a copy of the 1954 First Prize Winning Paper, "How to Prevent Hydraulic Shock in Mobile Equipment"!

Anyone active in the design, construction, operation or maintenance of hydraulic or pneumatic equipment, no matter where it is applied, is eligible to compete. Simply write the APPLIED HYDRAULICS Prize Paper Contest Editor.

Flow Meters on Hydraulic Systems

While we seldom see hydraulically powered machines which incorporate an accurate flow meter as a part of the circuit, we feel certain that their use will become more common. Hy Cutler, one of Snyder Tool & Engineering Company's design engineers, tells why flow meters were installed on a wheel boring machine they built. His article also describes the operation of a precision variable area type flow meter and tells how to measure flow in a hydraulic system.

Precision "O" Rings make these Quick-Connect couplings leak-proof!

Hydraulic, pneumatic and other fluid lines can be connected or disconnected quickly, easily and safely with the two-way shut-off couplings made by **The Hansen Manufacturing Company** of Cleveland. When connected the Hansen coupling permits a free flow through it—and a **Precision "O" Ring** makes the vital seal which insures a long life of leak-proof service.

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Valve action is chatter-free for efficient operation on high or low pressure applications.

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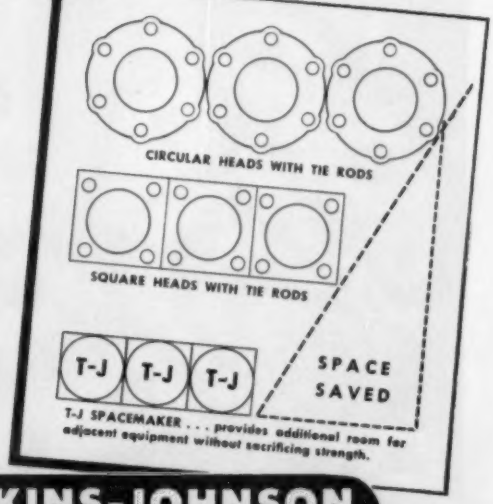
- ★ Super Cushion Flexible Seals for Air . . . New Self-Aligning Adjustable Oil Cushion
- ★ Hard Chrome Plated Bodies and Piston Rods

Compare feature by feature—you'll see why T-J Spacemaker Cylinders are today's top choice for streamlined power movement in automation! The only cylinder with all the extras as standard. Write for bulletin SM-454-2. The Tomkins-Johnson Co., Jackson, Mich.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SQUARE HEADS WITH TIE RODS
T-J
T-J
T-J
SPACE SAVED
T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

T-J TOMKINS-JOHNSON

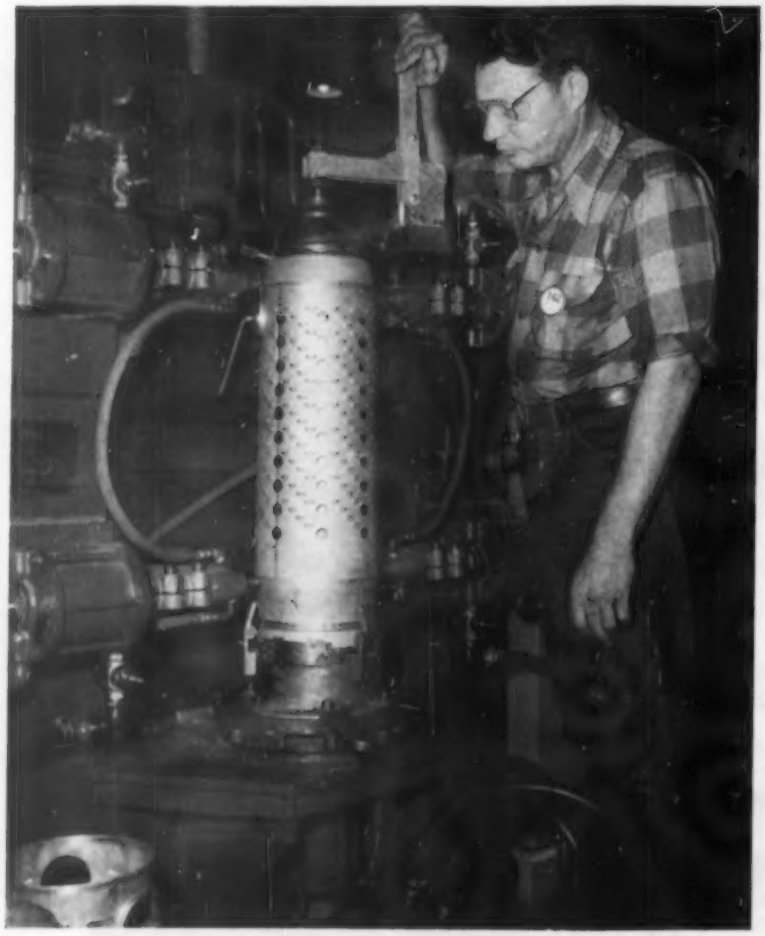
RIVITORS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHORS

BRIEFS about fluid power

FOUR WELDS AT ONE BLOW

For use in production of jet engine components is this post-spot tacking machine designed by the Thompson Welding Machine Company. This metal "stitcher" serves as both an assembly and fabrication machine in the manufacture of jet engine inner combustion chambers. It quickly aligns the three major parts of the combustion chamber and spot tacks them together prior to seam welding.

Air cylinders power the spotwelds and the clamps which hold the work.



The combustion chamber shell, exit shell and cap are placed on a brass and copper arbor. With a touch of a footswitch the expanding sections, at top and bottom of arbor, move outward bringing the assembly into exact alignment and concentricity. Another foot control causes the four horizontal electrodes to move in simultaneously, discharge their welding current, making four spot tacks at each impulse. The assembly, rotated automatically, makes a total of 32 spot tacks in eight rotations.

Previously, assembly of this structure required two workers, one assembling the parts and one to hold it while single spot welds were made. All this handling has been eliminated by the new machine and one operator can assemble this component five times as fast as two employees could formerly.

▼▼▼

Pneumatics For Model Railroads

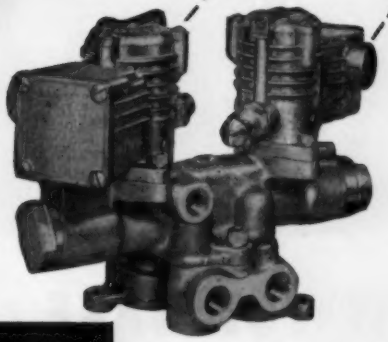
Here's something new for model railroad enthusiasts. You can now go another step nearer to the real thing by applying pneumatic power.

For the pneumatic operation of model switch points, Raymark Products Co., have introduced a range of pneumatic components of extremely small size. Components so far offered, with model railroads chiefly in mind, include one size of cylinder, a three-way control valve,

Continued on page 14

DOUBLE

solenoid
pilot operated
control valve



SPEED KING

Valvair is proud to announce another advancement in the field of automation—The Double Solenoid Speed King Control Valve, designed especially for both the Original Equipment Manufacturer and the End User. This development proves that, more than ever before, Valvair is the name to keep in mind when you order solenoid-operated valves.

Features: Momentary electrical contact—35 to 200 psi pneumatics with internal pilot supply—35 to 150 psi hydraulics with internal pilot supply—Vacuum—300 psi pneumatics and hydraulics using external or remote pilot supply—4-way body—foot or manifold mounting—basic ⅜" and ¾" sizes.

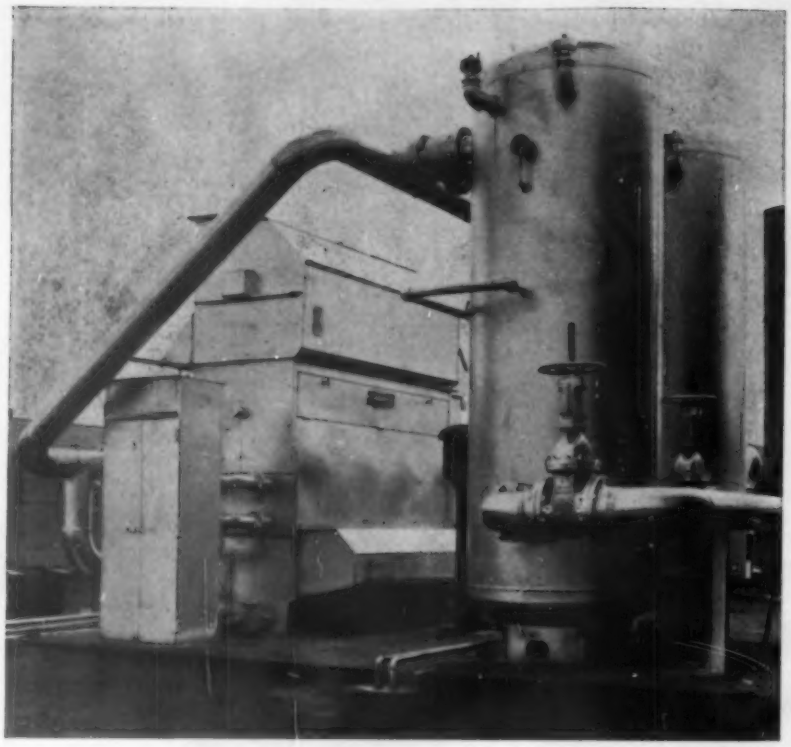
ASK FOR BULLETIN A 12

Valvair

951 BEARDSLEY AVENUE • AKRON 11, OHIO

Affiliate: Sinclair-Collins Valve Company

Representation in: Baltimore • Birmingham • Boston • Buffalo • Charleston, W. Va. • Chicago • Cleveland • Cranford, N. J. • Dayton • Denver Detroit • Eureka, Calif. • Houston • Kansas City, Mo. • Logansport, Ind. • Louisville • Minneapolis • S. Pasadena • Philadelphia • Pittsburgh Portland • St. Louis • Seattle • San Francisco • Syracuse • Montreal • Toronto • Vancouver



HOW YOU SAVE,
Getting Drier Compressed Air

● Direct saving in the cost of cooling water saves the price of the Niagara Aero After Cooler (for compressed air or gas) in less than two years.

Extra, for no cost, the drier air gives you a better operation and lower costs in the use of all air-operated tools and machines, paint spraying, sand blasting or moisture-free air cleaning. Water saving also means less expense for piping, pumping, water treatment and water disposal, or you get the use of water elsewhere in your plant where it may be badly needed.

Niagara Aero After Cooler assures all these benefits because it cools compressed air or gas below the temperature of the surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air thru a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter by the Niagara Balanced Wet Bulb Control.

Write for complete information; ask for Bulletin No. 98

NIAGARA BLOWER COMPANY

Dept. AH, 405 Lexington Ave. New York 17, N. Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

BRIEFS continued

manifolds for feeding up to ten single valve and cylinder circuits, tees, connectors, 1/8 inch bore plastic tubing, adapters for connection of the tubing to a 1/8 inch pipe thread, air receivers and pressure gauges.

The cylinder is of 3/8 inch bore, 1/2 inch outside diameter and has a 1/2 inch stroke. Length of cylinder is 1 1/8 inch, total length of unit including foot mounting bracket is 1 7/8 inch. The cylinder is of single-acting type with spring return, piston is sealed with single Neoprene O-ring. The three-way type valve has one inlet, one outlet and one exhaust port, is 1 3/4 inch long and its maximum diameter is 13/16 inch.

The units, of rugged construction, will operate equally well on compressed air, suitable gases or water. ▼▼▼

Hydraulic Pivot Tilts 150 Degrees

A drum handling problem was solved by Lewis-Shepard, materials handling equipment manufacturer, by designing and manufacturing a

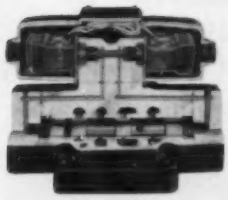
new device—a special drum up-ender attachment. Besides lifting and carrying the drums, their contents had to be dumped into large vats.

One man and one truck complete the entire operation. Fork arms are

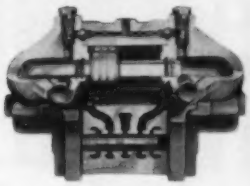
Continued on page 16

NEW RACINE FLUID MOTOR

PROGRAMMED RESEARCH FOR PRODUCTION PROGRESS

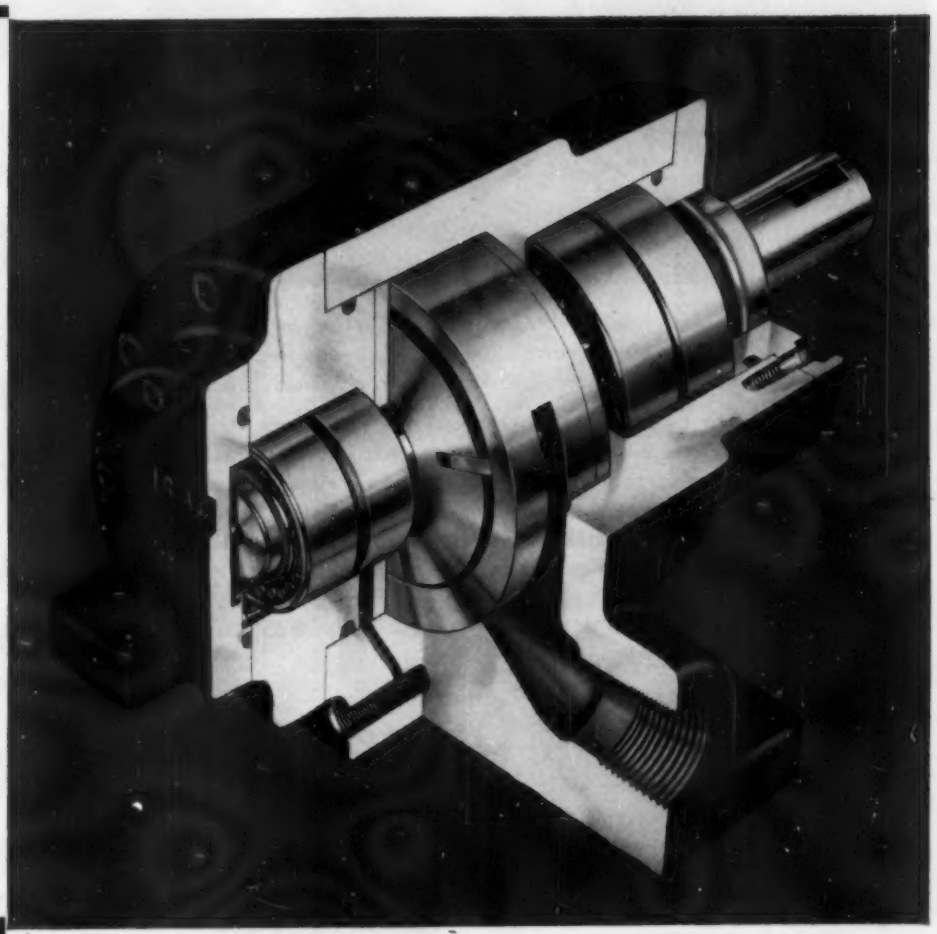


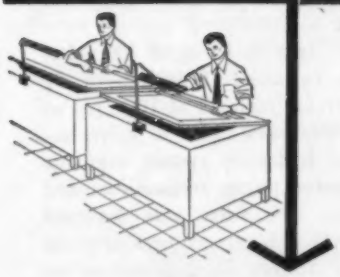
Twin Solenoid Pilot Operated 4-Way Valve



Hydraulic Pressure Booster Pressures to 5000 p.s.i.

Hydraulic Power Unit Designed for your needs





A vane type constant displacement Fluid Motor that features simplicity and compactness of design. It is ruggedly built for continuous operation at pressures up to 1500 p.s.i. and Speeds of 50 to 3500 rpm.

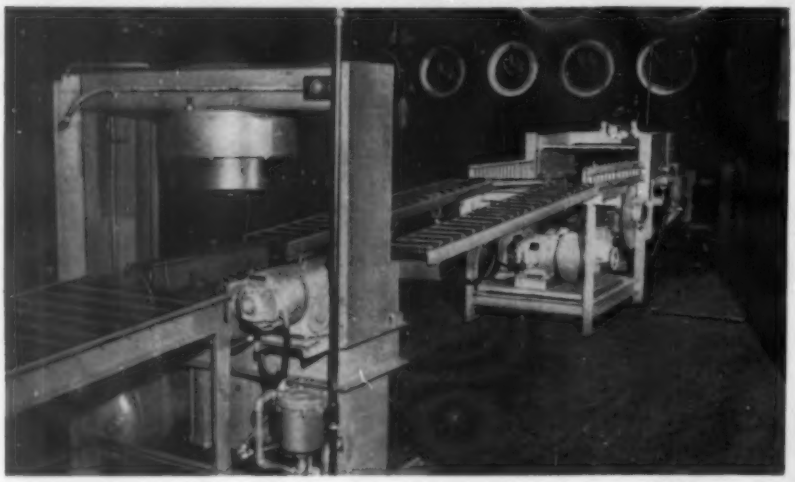
Torque is constant at any degree of rotation. Heavy bearing construction will support overhung loads equal to full torque on a 6" diameter wheel plus a 100 pound external end thrust.

Write for prices and complete information on RACINE'S full line of Hydraulic Equipment. Address **RACINE HYDRAULICS & MACHINERY, INC.**, 2074 Albert Street, Racine, Wisconsin.

RACINE

"THEY WORK BETTER TOGETHER"

AIRWAY PRODUCTS *produces a* SPECIAL *automatic tubeless tire mounting and inflating line*

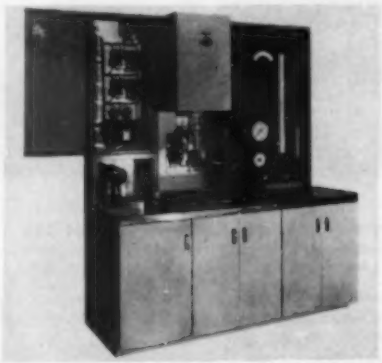


PROBLEM: *A fast, simple, straight line method of mounting and inflating tubeless tires at speeds necessary to meet needs on automobile production lines.*

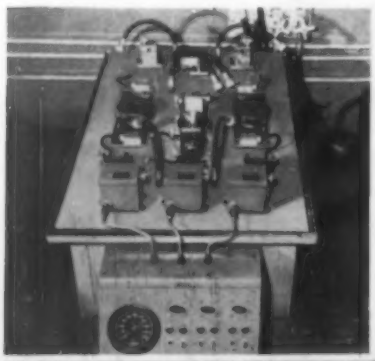
SOLUTION: The photograph above shows the equipment, designed and made by Airway Products, that solved the problem. Tires are automatically mounted on rims and as they come under Airway's exclusive inflator head, are inflated automatically by depressing the sidewalls, then pass along to be mounted on automobiles. Capacity in excess of 500 per hour. Airway Products is ready at all times to design and furnish automated tire lines to your specific requirements.

Send today for our illustrated folder.

The latest type of hydraulic equipment for testing automotive-type vacuum pumps.



Hydraulic and electronic testing stand used in the guided missile program.



AIRWAY PRODUCTS, INC.
BOX 2025 HURON GARDENS STATION
PONTIAC, MICHIGAN
AIRCRAFT
AGRICULTURAL
AUTOMOTIVE
COMMERCIAL
DESIGNERS
ENGINEERS
API

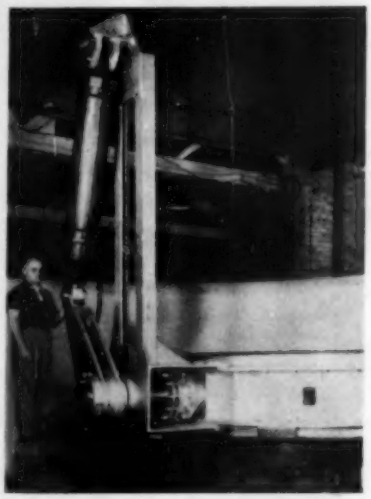
AIRWAY FOR HYDRAULIC, PNEUMATIC and MECHANICAL AUTOMATION

BRIEFS continued

adjustable hydraulically, thus enabling the drums to be clamped securely. In order to dump the contents into large vats, a hydraulically controlled pivot was added which tilts the container 150 degrees forward.

All of these motions are controlled by the operator from his driving position. ▼▼▼

10" Oil Cylinder Powers Giant Butterfly Valves



One of the largest butterfly valves ever built was designed and constructed by W. S. Rockwell Co. Installed at a government's aeronautic laboratory, it is used to control the volume, speed and pressure of the wind to which planes are subjected in test.

The blade is actuated by a hydraulic cylinder, 10 inch bore, 51 inch stroke, with oil at 1000 psi as the power medium. The valve has its own hydraulic system complete with motor, pump, accumulator and controls. The valve was designed to handle air at temperatures up to 390 degrees F, at pressures up to 15.3 psi. A power unit of this size is capable of developing a theoretical torque of 3,300,000 in-lb. ▼▼▼

Continued on page 18

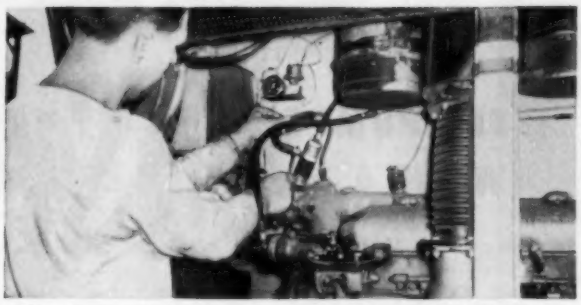
Your Products Deserve Aeroquip Hose Lines

BECAUSE

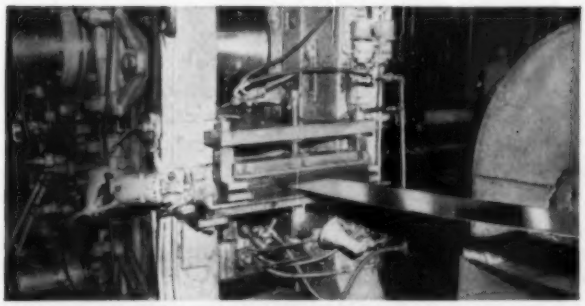
YOUR CUSTOMERS PREFER AEROQUIP

READ WHAT THESE TYPICAL EQUIPMENT OPERATORS SAY:

● **Nick Martino, master mechanic, of American Construction Company, Inc.: "Aeroquip's superior quality hose and reusable fittings mean less headaches due to downtime."** (*Operators of construction equipment*)



● **Albert Schardl, maintenance foreman, New Britain Transportation Company, Inc.: "Aeroquip has prevented road failure due to hose breakage. Within the next six months we expect to be 100% Aeroquip . . ."** (*Bus operators*)



● **Peter Wallace, maintenance superintendent, Wallingford Steel Company: "Aeroquip is better because of quick installation. It stands continuous abuse and increases safety."** (*Operators of steel rolling equipment*)

● **Al Herbert, superintendent, National Welding Manufacturing Co.: "We had worlds of trouble with pipe and fittings breaking from vibration. Aeroquip solved this problem. Now we are standardized on Aeroquip."** (*Users of air tools*)

Engineering assistance is available . . . write for complete information.

Aeroquip

REG. TRADE MARK

AEROQUIP CORPORATION, JACKSON, MICHIGAN

LOCAL REPRESENTATIVES IN PRINCIPAL CITIES IN U.S.A. AND ABROAD • AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD

LITTLE PUMPS WITH A **Big Squeeze**

SECO radial pumps generate pressure *within* HOLLOW PISTONS. The higher the pressure the tighter the seal. No loss of mechanical efficiency. The piston assembly is completely surrounded by pressure lubrication and literally floats in a hydrostatic film of oil during the pressure stroke.

For operations requiring extremely high pressure during some part of a cycle, a SECO Series LA pump will give you that "big squeeze" at a point where the muscles of a larger, big volume pump begin to "tire out."

Or, for applications where no large fluid volume is required, but where higher working pressure would *reduce the bulk of all components*, these pumps will deliver pressures up to 10,000 PSI—with no servicing problem worth considering.

If however, you use only pressures up to the widely accepted 5,000 PSI range, consider this: At such pressures SECO pumps merely loaf, so far as stress and wear are concerned.

These pumps are made in 5 models, delivering from ½ GPM to 5 GPM, and developing pressures of 3,000 PSI to 10,000 PSI. *Whether your interest is in higher pressures, or simply in longer pump life and freedom from servicing—Send for complete information.*

SIMPLEX ENGINEERING CO., ZANESVILLE, OHIO

SIMPLEX ENGINEERING CO.
Zanesville, Ohio

SECO

Please send complete information on SECO Series LA Pumps.

Name _____ Title _____

Company _____

Address _____

BRIEFS continued

"Hot-Cold" Box for Testing

A wide variety of atmospheric conditions can be established in this new hot-cold box at Walter Kidde & Company Inc.'s Development Laboratory, Belleville, N. J. Valued at over $125,000, the box creates temperatures of from minus 100 to plus 300 F., atmospheric pressures equivalent to altitudes of up to 80,000 feet, and establishes humidity conditions of from 20 to 95 percent. Here

A. E. Schmidlin (right), in charge of Kidde's aircraft air compressor development program, and John Kapp, project engineer, check final adjustments to an aircraft air compressor before starting a test run. The massive door which seals shut the chamber rises out of the floor. Hydraulic and pneumatic outlets are visible on the chamber's right wall. A wide variety of electrical connections are available on the left wall.

▼▼▼

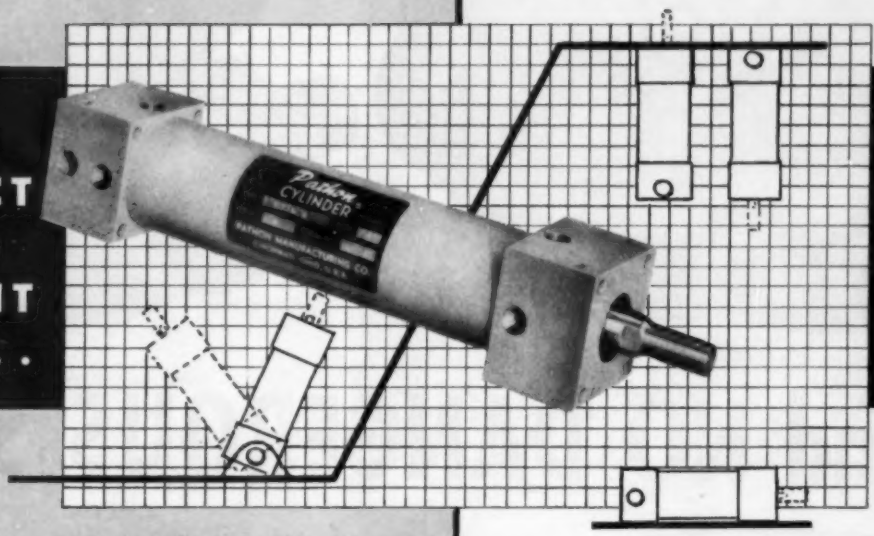
Aviation Trade Show

The Fourth International Aviation Trade Show will be held May 4-6, at the 69th Regiment Armory, New York City. Planned to bring together buyers, sellers and designers of aircraft materials, products and services, this exposition will offer the latest developments in the aviation field. ▼▼▼

Complete Flexibility with a Pathon

series "U" UNIVERSAL MOUNTING AIR CYLINDER

. . . they're COMPACT RUGGED EFFICIENT too . . .



Here is a new series of extremely compact air cylinders which require very small mounting area. You get four mounting types—foot, front flange, rear flange, and clevis provided integrally by drilled holes in the heads. The installation is much more rigid and assembling or stocking of miscellaneous attaching brackets is eliminated.

Stainless steel piston rods and hard drawn brass barrels assure corrosion resistance with low frictional characteristics.

STOCK SIZES: Cylinders available for immediate delivery in these sizes. **Part Numbers and Prices Shown.**

Stroke	1⅛"	1⅝" Bore	2"	2½"	3"
1"	UA1⅛MA1 26.00		UA2MA1 34.95		UA3MA1 46.00
2"		UA1⅝MA2 28.20	UA2MA2 35.60	UA2½MA2A 51.00	
4"	UA1⅛MA4A 35.20		UA2MA4A 45.20		UA3MA4A 58.40
6"		UA1⅝MA6A 38.20	UA2MA6A 46.50	UA2½MA6A 55.00	
8"	UA1⅛MA8A 36.80		UA2MA8A 47.80		UA3MA8A 62.00
10"		UA1⅝MA10A 40.20		UA2½MA10A 58.20	
12"			UA2MA12A 50.40		UA3MA12A 65.60
15"				UA2½MA15A 62.20	

"A" suffix denotes adjustable cushions both ends

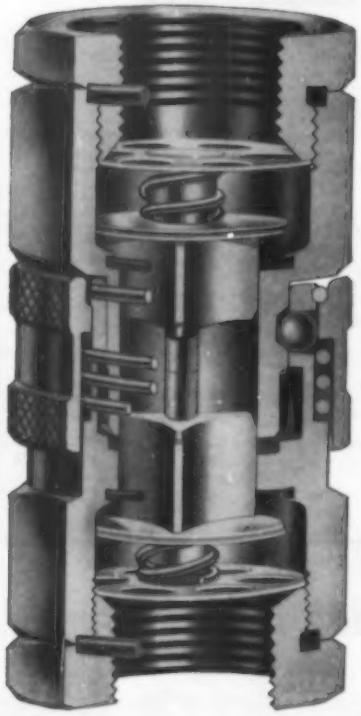
Write for further information today!

Pathon MANUFACTURING CO.

3823 PACIFIC AVENUE
CINCINNATI 12, OHIO

DISCONNECTED IN 1 SECOND

and NO DANGEROUS SPRAY



INSTALL SNAP-TITE "H" COUPLINGS:

- Snap-Tite "H" Series couplings are constructed so that the valve is completely closed in coupler before disengaging the nipple seal, eliminating fluid spray, and the only loss of fluid is the few drops in the nipple cavity.
- Powerful springs keep valves shut tight when "H" couplings are disconnected.

Check your couplings. Are they creating accident hazards and losing costly fluids? Are offensive odors and flammable gases escaping from them?

SNAP-TITE'S "H" COUPLING, SIZE FOR SIZE, IS THE SMALLEST COUPLING WITH HIGHEST STRENGTH AND HIGHER EFFICIENCY

Recessed valve washers . . . fluted valve stems . . . valve stops with minimum flow restrictions . . . large inside diameter—these combine to allow maximum flow capacity with lowest pressure drop.

Available in sizes ⅛" to 10" in alloy steel or to specifications

SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

See the Snap-Tite representative in your city or write for Bulletin 240A

Snap-tite, INC.
UNION CITY 1, PENNSYLVANIA

Useful Literature

For your free copy of publications reviewed, fill in the reader service card

AIR VALVES . . . are the subject of a comprehensive 44 page catalog, No. 51, published by Ross Operating Valve Company. Among the many standard types illustrated and described are hand, foot, cam and solenoid valves, master valves for remote control operations, and small valves for pilot control with hand, foot, cam or solenoid operation. Also shown are speed control and other special purpose valves. Sectional drawings detail construction features of each type valve. Several pages are devoted to general reference data and installation diagrams.

Fill in No. 110 on Reader Service Card

PRESSURE GAUGES . . . for various applications are described in Catalog M-5 available from Acragage Corp. It shows construction details of gauges available with a choice of Bourdon spring material dependent on the type of corrosion resistance required and the pressure range of the gauge. Also featured are solid front case gauges, phenol case gauges, electric transmitter gauges. Standard gauge dial graduations, net weights and mounting dimensions are listed.

Fill in No. 111 on Reader Service Card

HIGH PRESSURE COMPONENTS . . . are featured in Martin-Decker Corp.'s 4-page bulletin, M-15. It illustrates a hydraulic pressure booster which, when connected to water and air supplies, can build up pressures as high as 25,000 psi. Simple to install, easy to operate, the unit has no motors, pumps or gears. Also shown are check valves, made of cold rolled steel, brass or stainless steel, available in working pressures up to 25,000 psi; and self-sealing couplings, designed to fit either male or female ¼ N.P.T. threads.

Fill in No. 112 on Reader Service Card

HOSE COUPLINGS . . . designed for one-hand operation are described in a new brochure prepared by Breco Manufacturing Co., Inc., Division of Perfecting Service Company. The bulletin, 54-1R, shows a variety of styles and types of couplings featuring quick connect-disconnect operation without turning or twisting to lock, just push in. Automatically locks, making high pressure leakproof connection. Integral check valve automatically shuts off line or hose pressure when disconnected, prevents danger of backlash or whipping. Couplings can be used for applications up to 10,000 psi.

Fill in No. 113 on Reader Service Card

CAPS AND PLUGS . . . to protect and seal threads, tubing and fittings are described in a new file folder. Prepared by Protective Closures Co., Inc., the folder describes fully the complete line of threaded and non-threaded caps and plugs. Made of tough, flexible polyethylene, these products will not chip or break and will retain form stability. The folder includes price lists for over 100 stocked sizes of five standardized designs.

Fill in No. 114 on Reader Service Card

POSITIVE DISPLACEMENT PUMP . . . of new design, introduces a controlled floating vane. Circon Pump Company prepared a specification sheet outlining the features of this pump, in which the floating vanes can be controlled both radially and laterally.

Fill in No. 115 on Reader Service Card

FLUID POWER EQUIPMENT . . . manufactured by The Oilgear Company is detailed and illustrated in a new 12-page bulletin, 10051-D. Literature shows pumps, motors, transmissions, cylinders, valves and accessories. Also featured are a new electric-hydraulic servo control system for pumps and transmissions up to 150 hp, a new line of Oilgearducers for constant torque drives.

Fill in No. 116 on Reader Service Card

AIR CYLINDERS . . . which feature built-in valves in the rear head are detailed in The A. K. Allen Co.'s new 4 page bulletin. Shown are Models SVA and SVE, available in 2 inch and 3 inch bores and any length of stroke up to 60 inches. The built-in valves are of the slider type, slider is actuated by a spool whose instantaneous motion is achieved through two bleeder valves. A choice of mounts is available for mounting cylinders in any position.

Fill in No. 117 on Reader Service Card

For more reviews of Free Literature turn to page 77

New Products

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

HYDRAULIC GEAR PUMP
. . . delivers up to 42 gpm at 2000 psi

Designation: H Series

Design: New type extra heavy bearings back up and assure perfect alignment of the matched ground gears. Pressure pocketing traps high pressure behind the thrust plates to maintain pressure loading against gear faces and also reduces running clearance.

Features: A special designed outboard bearing heavier than one used previously will absorb all drive shaft loadings, even shock loadings when encountered under the most extreme conditions. Since slippage is so low, volumetric efficiency runs higher than 90 per cent. More than one single pump can be built in tandem on one common shaft for direct connection to one power source and yet each pump is independent of the others.

Sizes: Single pumps built in a range of sizes give a discharge volume from 12 to 42 gpm at 1200 rpm.

The Commercial Shearing and Stamping Co.
Youngstown, Ohio

Fill in No. 140 on Reader Service Card

AIR VALVES
. . . for hand and foot operation

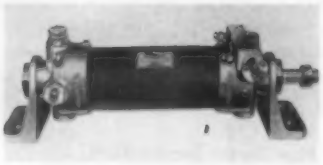
Designation: 880 Series

Features: Improvements are now incorporated in the operating mechanisms of both the three way and four way models. These valves are now available with single foot treadle, double foot treadle, vertical hand lever or horizontal hand lever controls. They are easily changed from hand to foot operation. A separate base for bottom or side ports is provided and an optional base is available to permit manifolding a series of bases to each other for simplified piping. All models have standard two position locking action, but may be ordered with spring return or three position locking action.

Sizes: Pipe sizes include ¼ inch and ⅜ inch in three and four way models. Pressure rating is 125 psig and maximum recommended operating temperature is 175 degrees F.

Ross Operating Valve Company
Detroit, Michigan

Fill in No. 141 on Reader Service Card



AIR-HYDRAULIC CYLINDER
. . . of co-axial design

Design: The air cylinder surrounds the oil cylinder in this co-axial unit, avoiding the excessive length encountered with in-line types of air-hydraulic cylinders. Expanding exhaust air also helps cool the oil to assure dependable operation under continuous rapid cycling and heavy loads.

Features: Automatic models are available with built-in controls of speed, direction, adjustable fast traverse in either direction, and automatic recycling. Standard models can be remotely controlled with conventional valving and piping.

Specifications: Available in any stroke length to 72 inches. Unit develops hydraulic piston thrust of 3.14 x airline pressure, and pull of 2.7 x airline pressure.

Modernair Corporation
San Leandro, Calif.

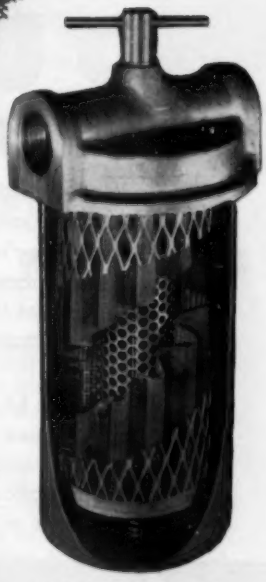
Fill in No. 142 on Reader Service Card

Continued on page 24

SUMP TYPE (Cutaway)

For Dependable Protection on your HYDRAULIC EQUIPMENT

MARVEL SYNCLINAL FILTERS



LINE TYPE (Cutaway)

Hydraulic Oils MUST BE CLEAN!

to Protect Equipment—
Increase Production—
Reduce Maintenance

PRODUCTION ENGINEERS and MAINTENANCE MEN, whose job it is to keep production machinery operating at peak efficiency, are specifying Marvel Synclinal on new equipment and standardizing with Marvels throughout their plants.

OVER 500 ORIGINAL EQUIPMENT MANUFACTURERS of hydraulically actuated equipment or machines utilizing low pressure liquid circulating systems, also recognize the superiority of Marvel Synclinal Filters in serving this purpose and are installing them as standard equipment.

It's The ACTIVE Filtering Area That Counts!

The Synclinal design of Marvel Filters provides that all-important balance between maximum ACTIVE filtering area and sufficient storage capacity for filtered out particles. Thus, longer periods of productive operation are attained before filter cleaning is necessary. Marvel Synclinal Filters are easy to clean because both the sump and line type may be disassembled, thoroughly cleaned and reassembled in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G. P. M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

IMMEDIATE DELIVERY

As in the past, Marvel continues to offer IMMEDIATE DELIVERY.

FILTERS FOR NON-FLAMMABLE HYDRAULIC FLUIDS

Marvels most recent development is a filter for the efficient filtration of all types of non-flammable hydraulic fluids.

Catalogs containing complete data available on request

MARVEL ENGINEERING CO.

625 W. JACKSON BLVD., CHICAGO 6, ILL.
PHONE: FRANKLIN 2-4431 & FRANKLIN 2-3530

Without obligation, please send me complete data on Marvel Synclinal Filters as follows:

Catalog No. 106 for Hydraulic Oils, Coolants, Lubricants
Catalog No. 300 for Water
Data on filters for non-flammable hydraulic fluids

AH-2

Name ..... Title .....

Company .....

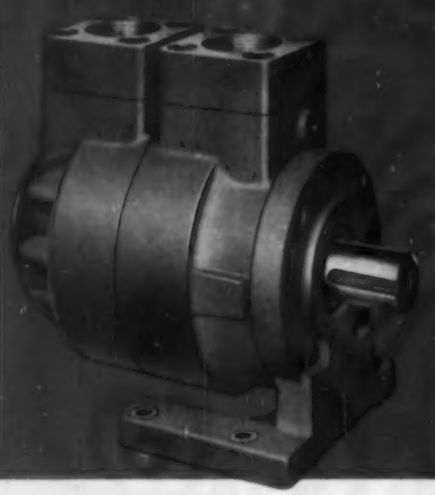
Address .....

City ..... State .....

Brute Strength or Delicate Handling of Rotary Power Functions . . .

TWO VANES ARE BETTER THAN ONE

The hydraulically balanced DUAL-VANES in DUDCO Fluid Motors, as contrasted with conventional designs, maintain MULTIPLE AREAS OF CONTACT ON THE CAM RING . . . doubling the number of effective barriers to slippage and power loss. This patented principle is an exclusive DUDCO feature!



DUDCO
FLUID MOTORS

Compact and sturdy, DUDCO DUAL-VANE Fluid Motors operate quietly and smoothly under the most strenuous conditions. They're built to "take it" . . . frequent reversals, rapid accelerations or stalling under load. With DUDCO you get the big advantage of 2000 psi operation at a cost comparable with that of lower pressure equipment.

DUDCO is a big, exciting story for every hydraulics engineer because . . . power losses are minimized and operating efficiency is higher . . . starting torques are high . . . operation is smooth, quiet and exceptionally free from wear or maintenance problems.

On Conveyor systems for agricultural, food processing, mining and other industries, DUDCO DUAL-VANE Fluid Motors provide the extras in performance that save time, money and labor. Operating

the winches on a giant tank retriever and other large mobile equipment calls for high starting torque and the dependable power of DUDCO DUAL-VANE MOTORS.

Write for Bulletin DM-301 fully describing DUDCO DUAL-VANE Fluid Motors today!

DUDCO DIVISION
THE NEW YORK AIR BRAKE COMPANY
1704 EAST NINE MILE ROAD • HAZEL PARK • MICH.

New Products / continued

SERVO VALVE
. . . controls hydraulic flow

Designation: FC-2

Design: A two stage, four way valve. Its pilot stage is a hydraulic amplifier of the nozzle type driven by a torque motor employing the polarized relay principle. A miniature, high force, positional feedback loop between the torque motor and main spool position, encloses the nozzle stage.

Features: Torque motor, of balanced coil resistance construction, is supplied in ranges of 200 to 3000 ohms DC resistance per coil. Signal levels as low as 6 ma differential current produce full valve flow when using the 3000 ohm coils. Supply pressures of from 500 to 3000 psi may be employed. When operating in a 3000 psi system, a typical valve can deliver to the load a peak power of 10 hp.

Applications: For use in servo loops where high dynamic performance at high force levels is required.

Cadillac Gage Co.
Detroit, Michigan

Fill in No. 143 on Reader Service Card

HYDRAULIC FEED UNIT
. . . for automatic machines

Designation: Model E

Design: Ram of this model is coaxial with the spindle, exerting its force directly behind the head. Splined spindle shaft extends through the center of the cylinder, piston and ram, and projects through the face of the ram head. Spindle driving sheaves are mounted on a housing to which the cylinder head is attached.

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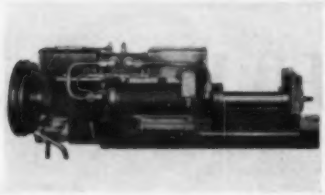
Features: Quick change-over from job to job is made possible by the design of the spindle support. A double solenoid valve is employed to operate the ram in both directions. When synchronized with other units,



this valve is interlocked in such a way as to return the ram in case of emergency.

Specifications: This 1½ hp unit is obtainable with a ram stroke of 6, 9 or 12 inches. Feed rate is 0 to 8 inches per minute, with a traverse speed of 240 inches per minute. Since pump and spindle are driven independently, pump speed can be set for any traverse speed required to synchronize with other units. Spindle speed can be set for 600 to 3600 rpm.

Rock River Engineering Company
Rockford, Illinois
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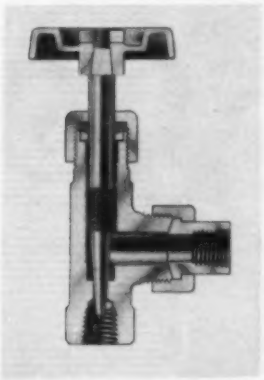
NEEDLE VALVE
. . . with micrometer thread

Designation: Bull-Dog

Construction: Bodies are forged from brass, stainless steel or carbon



steel. This new line of valves has universal outlets featuring micrometer thread stainless steel stems.

Applications: Metering fluid or for speed control.

Carpenter Valve Corporation
Cleveland, Ohio
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Continued on page 27

These famous Gear Type Motors operate with pressures up to 1500 psi. Available in flange or foot-mounted models, in a complete range of sizes to 52 hp. They feature the exclusive HYDRECO Four Bolt design which places greatest strength in the area of greatest pressure.

with
HYDRECO
FLUID MOTORS

You find the answers to so many problems in the wide experience of HYDRECO engineers . . . especially where a function involves rotary motion. Powering the sweeper or the snow blower on municipal equipment, driving conveyor belts on trenchers, or shaking walnuts out of the trees at harvest time . . . these are but a few of hundreds of money-saving operations HYDRECO Fluid Motors are called upon to perform.

HYDRECO Fluid Motors, with their high starting torque, instant reversibility, and capacity for handling rugged and seemingly impossible assignments, are the natural choice of design engineers. HYDRECO dependability stems from the fundamentally sound "Pressure-Balanced" design, unmatched craftsmanship and the "know-how" of thousands of outstanding hydraulic applications.

Write *for full information on HYDRECO Hydraulic Pumps, Motors, Valves and Cylinders today!*

HYDRECO DIVISION
THE NEW YORK AIR BRAKE COMPANY
1104 EAST 222nd STREET • CLEVELAND 17 • OHIO

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OUR IDEA WAS TO BUILD A BETTER VALVE...

Seemed like a sound one to us.

Machines and methods had improved. Automation came along. But air valves had been basically unchanged for twenty years. Too bulky, too complicated, too difficult to service, in our estimation.

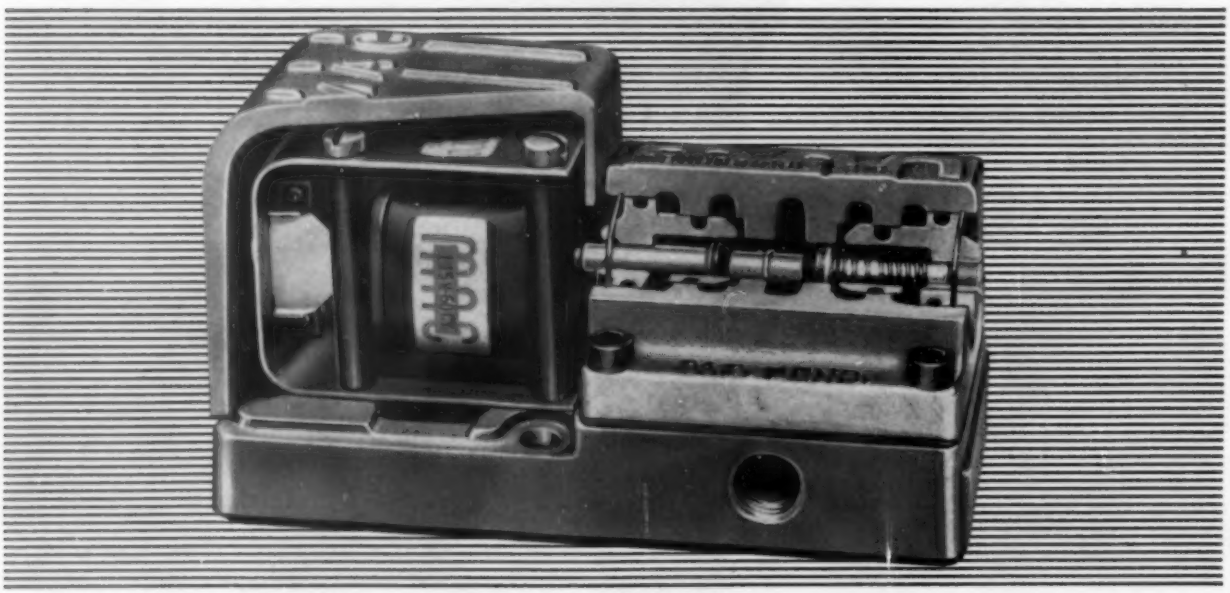
So, here at MAC, we simplified air valve design.

Instead of twenty or thirty parts, we engineered a valve with just eleven. Only *one* moves—the spool—so there's only one to wear. Our valve is lightweight—eight pounds, instead of ten to eighteen. And smaller. The ⅜", 4-way MAC solenoid air valve, for example, is just 3"x3"x7"—about the size of a pound of butter.

It's the easiest valve we know of to service. You can get at the spool by simply removing the retainer. No need to touch the piping at all. For that matter, a MAC valve seldom *requires* maintenance. On the toughest jobs, our valves have run for *millions* of cycles without being touched, thanks mainly to precision workmanship with only the most reliable of materials and the quality checks every valve must pass before it leaves our plant.

If you like the idea of simplicity in valve design—better performance at lower cost—get in touch with us. Nothing will please us more than to have you *compare* MAC valves. We'll be happy, also, for the chance to lend our "know-how" to any air control application you have in mind.

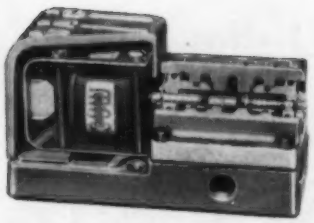
No obligation, of course. Write us now.



CUTAWAY VIEW OF ¼", 4-WAY MAC solenoid-operated spring return air valve. A complete line of valves for virtually any application is available. Standard, or made to order.

MECHANICAL AIR CONTROLS, INC.
10030 Capital, Oak Park, Detroit 37, Michigan

MAC



SEE YOUR NEARBY "MAC" REPRESENTATIVE FOR DATA AND DELIVERY

CALIFORNIA
OAKLAND—The Rucker Company, 4228 Hollis Street, Oakland 8, OLympic 3-5221
SOUTH GATE—The Rucker Company, 4956 Firestone Boulevard, South Gate, Kimball 8271
GEORGIA
ATLANTA—Edward M. Watkins & Associates, 3230 Peachtree Road, N. E., Atlanta, Exchange 5664
ILLINOIS
CHICAGO—Mechanical Air Controls, 10336 South Western Avenue, Chicago 43, Hilltop 5-3640
INDIANA
FORT WAYNE—Neff Engineering Company, P. O. Box 2001, Station A, 2339 Crescent Avenue, Fort Wayne 3, EAstbrook 7391
INDIANAPOLIS—Jack Neff, 3246 East 38th Street, Indianapolis, HUmbolt 6421
SOUTH BEND—Dick Futter, 103 South Varsity Drive, South Bend, 2-4856
MASSACHUSETTS
BOSTON—Electrical Apparatus Company, Inc., 1200 Soldiers Field Road, Boston 34, STadium 2-7440
MICHIGAN
BAY CITY—Fred Kober, 506 Chilson Street, Bay City, 2-2629
FLINT—Kober Sales Engineering Company, 514 Beach Street, Flint, 8-5123
GRAND RAPIDS—Kober Sales Engineering Company, 190 Monroe Avenue, Grand Rapids, GLendale 4-3252
MINNESOTA
MINNEAPOLIS—Air Engineering & Supply Company, 2445 Nicollet Avenue, Minneapolis 4, Fillmore 5579
ST. PAUL—W. H. Schulz Company, 2438 Franklin Avenue, St. Paul 14, Midway 2744
MISSOURI
ST. LOUIS—Oscar E. Jost, 2849 Sidney Street, St. Louis 4, PRospect 3-4790
NEW YORK
BUFFALO—C. H. Tepas Company, 200 Washington Highway, Buffalo 21, CIrcle 3210
NEW YORK—C. H. Ribble Company, 261 Broadway, New York 7, WOrth 4-6227
OHIO
CINCINNATI—R. W. Nichols Company, Fidelity Federal Savings Building, 2087-9 Sherman Avenue, Cincinnati, Norwood, ELmhurst 2440
DAYTON—R. W. Nichols Company, 407 Realty Building, Dayton, Michigan 4724
OLMSTED FALLS—R. W. Nichols Company, P. O. Box 6, Olmsted Falls, BErea 4-1379
TOLEDO—R. W. Nichols Company, 510 Manhattan Building, Toledo 4, MAin 8623
YOUNGSTOWN—R. W. Nichols Company, 202 Schwenn-Wagner Building, Youngstown 3, RIverside 4-4550
PENNSYLVANIA
PHILADELPHIA—Grand Air Hydro Division, K. Wm. Ostrom & Co., Inc., 3717 Filbert Street, Philadelphia 4, EVergreen 2-5444
TEXAS
DALLAS—Womack Machine Supply Company, 6409 Maple Avenue, Dallas 19, DIxon 6997
WASHINGTON
SEATTLE—The Rucker Company, Wite-Henry-Stuart Building, Room 203, Seattle, MAin 2783
WISCONSIN
MILWAUKEE—Neff Engineering Company, 2837 North 50th Street, Milwaukee, Hilltop 5-3340
CANADA
ONTARIO, HAMILTON—Higginson Engineering Sales, P. O. Box 23 (275 James, North), Hamilton, Ontario, JAckson 9-2262

MECHANICAL AIR CONTROLS, INC.
DETROIT 37, MICHIGAN

MAC

New Products continued

RELIEF VALVE
. . . uses new soft seat principle

Designation: Type 1

Design: New type Teflon seat enclosed in a retainer enables the valve to reseat with no leakage after each relieving cycle. Simplified design and few moving parts permit valve to be disassembled quickly and easily. The valve is made of stainless steel.

Features: The new principle incorporated in the design of the sealing disc, forces the line pressure to assist in the sealing action.

Applications: For use in hydraulic systems, compressed air, corrosive chemical processes and petroleum products production.

Specifications: Available with inlet sizes up to ¾ inch and with set pressures from 1500 psi to 15,000 psi.

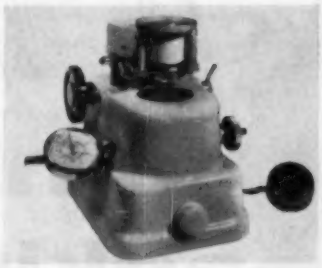
Anderson, Greenwood & Co.
Bellaire, Texas

Fill in No. 146 on Reader Service Card

MICRO HARDNESS TESTER
. . . for O-rings and seals

Designation: Micro Indentation Tester

Features: The instrument operates on what is known as the "null" reading principle, the null position of the indentor being indicated by an electronic circuit and ear-phones. Operator can hear loud signal in



ear-phone which decreases in pitch until immediately prior to reaching the null position. Then oscillation has reduced in frequency to a few beats per second. Main purpose of the instrument is to perform hardness or indentation tests on components or pieces of material which are too small to be tested properly in any other way. It also offers a method of studying creep or plastic flow.

H. W. Wallace & Co. Ltd.
Croydon, England

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CYLINDER
. . . has new cushion design

Designation: Series S

Design: Piston rod seal and rod wiper are mounted in a single cartridge which is easily removed to replace seals or wiper when required. The newly designed cushions prevent

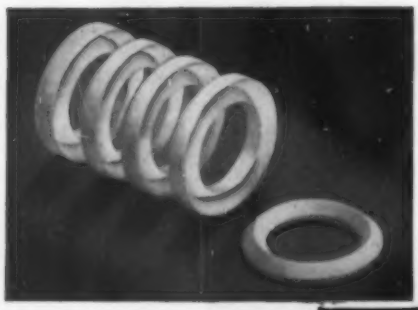
internal damage and excessive noise at the high speeds required. U-cup seals used on the piston and rod have flexible lips to assure positive sealing at low air pressures.

Continued on next page

chemiseal packing

MADE OF TEFLON duPont Trademark

...preferred by leading Hydraulics Engineers



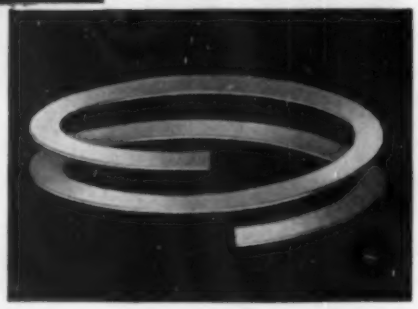
CHEMISEAL V-TYPE PACKING

Made of duPont TEFLON, Chemiseal V-Type Packings seal with low gland pressure and operating torque. Extremely anti-hesive, resilient, tough, chemically impervious (chemical inspections can be eliminated). Square-end TEFLON Adaptors available when required. Ideal for manual or automatically operated valves. Outlast other packings several times over. Catalog No. TP-1053.

CHEMISEAL BACK-UP RINGS

Made of duPont TEFLON, these rings have zero swelling in all hydrocarbons and the newer hydraulic fluids; are extremely anti-hesive, non-flammable, long wearing.

Service temperature range is minus 110° F. to plus 500° F. Lengthen "O" Ring life and prevent extrusion. Solid, split and spiral types available. Catalog No. OB-1152.



UNITED STATES GASKET COMPANY

CAMDEN 1, NEW JERSEY

USG | FABRICATORS OF FLUOROCARBONS & OTHER PLASTICS

Representatives in principal cities throughout the world

New Products / continued

Features: Cylinders can be operated by either air or oil with operating pressures up to 1000 psi. Units comply with both the JIC pneumatic and hydraulic standards.

Specifications: Available in bore sizes from 1½ to 8 inches in seven different mounting styles and offered in any stroke length. The units can also be furnished with hardened rods and special mountings.

The Hydro-Line Mfg. Co.
Rockford, Illinois

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DIFFERENTIAL RELIEF VALVE . . . will handle 24 gpm

Designation: Model D75

Construction: Made of a grey cast iron body; hardened steel plunger and seat; light spring gives long life with low stress. A pressure regulating screw gives valve smooth operation.

Applications: For the protection of hydraulic systems or for a constant working valve on systems using closed center control valves.

Sizes: ¾ inch NPT all ports; pressure range is 50-1250 psi.

Gresen Manufacturing Co.
Minneapolis, Minn.

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For more NEW PRODUCT reviews turn to page 82

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Fill in No. 56 →

Miller HIGH PRESSURE HYDRAULIC CYLINDERS

HARD CHROME PLATED PISTON RODS
Prevent Scratch-Damage, Nicks and Rust

SOLID STEEL HEADS, CAPS and MOUNTINGS
Eliminate Breakage

DIRT WIPER SEALS
Protect Rods, Seals, Bushings

Standard Leather Cup Seal Assembly Shown Is Interchangeable With Miller Standard Piston Ring Piston Assembly

Thousands of Different Selections For Immediate Delivery!

Rapidly expanding list of quality-famous Miller Cylinders for immediate, off-the-shelf delivery now includes thousands of different, popular selections—both hydraulic and air—cushioned and non-cushioned.

Bores up through 5" hydraulic, 8" air. Strokes up through 18". Over 30 different mountings.

Larger bores (up through 12" hydraulic, 20" air) and longer strokes (up to 22 feet) available on longer delivery.

Miller Boosters also in stock for immediate delivery.

Write For Catalog and Stock List

WRITE FOR CYLINDER BULLETINS H-104 and A-105

Complete Miller cylinder line includes: air cylinders, 1½" to 20" bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

MET J. I. C. HYDRAULIC STANDARDS years before their adoption in 1949.

SPACE-SAVING SQUARE DESIGN originated by Miller in 1945.

SALES AND SERVICE FROM COAST TO COAST

CLEVELAND • YOUNGSTOWN • DAYTON • PITTSBURGH • PHILADELPHIA • BOSTON • HARTFORD • NEW YORK CITY • BUFFALO • ST. PAUL • GRAND RAPIDS • DETROIT • FLINT • FORT WAYNE • SOUTH BEND • INDIANAPOLIS • MILWAUKEE • LOUISVILLE • KANSAS CITY • SEATTLE • LOS ANGELES • SAN FRANCISCO • BALTIMORE • DENVER • ST. LOUIS • MOLINE • CHICAGO • HOUSTON • TORONTO, CANADA and OTHER AREAS

Miller

MILLER FLUID POWER CO.
(Formerly MILLER MOTOR COMPANY)

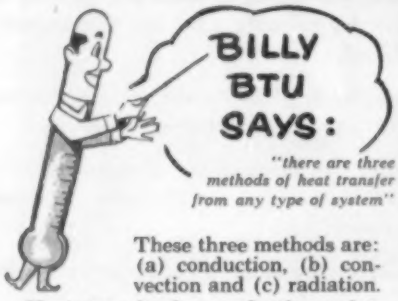
2008 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

Young Heat Transfer News

YOUNG RADIATOR COMPANY, RACINE, WIS.

Moslo Injection Molders Use Young Heat Exchangers to Cool Hydraulic Oil



These three methods are: (a) conduction, (b) convection and (c) radiation.

Heat transfer by conduction exists when heat flows within a body from one region of high temperature to another region of lower temperature by simple molecular communication. The amount of heat which can be transferred by conduction is dependent on the temperature difference, thermal conductivity of the material through which the heat is being conducted, the distance between the hot source and the cold sink, and the cross sectional area for heat flow.

Transfer of heat by forced convection depends on the velocity of the fluids over the surface through which heat is conducted . . . by the shape of the surface, by the area through which heat is conducted . . . and by various properties of the fluid as well as temperature difference.

The third general means of heat transfer is radiation. Here heat flows from the body of the higher temperature to the body of the lower temperature through space without any medium within the space. For further details on this subject write for free bulletin: "Heat: Forced Convection Removal From Industrial Hydraulic Circuits" to Young Radiator Company, Dept. 445B, Racine, Wis.

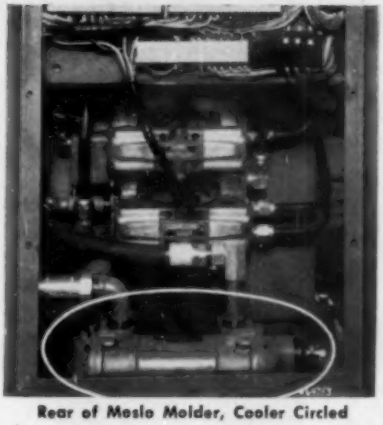
Front view Moslo plastics injection molder

Moslo Machinery Company, Cleveland manufacturer of plastics injection molding machines, specifies 'Young type "F" fixed tube bundle Heat Exchangers to dissipate heat generated in the hydraulic fluid during molding operations.

The Moslo plastics injection molder forces liquid plastic under high pressure into the mold chamber. Hydraulic fluid, pumped to high pressures, flowing through valves, relief valves, piping and cylinders increases in temperature to the point where equipment does not perform properly. Young heat exchanger controls this temperature to optimum operating limits.

Young Coolers use a minimum of cooling water passing through the tubes. They are engineered to minimize pressure drop in the hydraulic fluid circulating through the shell side of the 2-pass exchangers. Hydraulic fluid operating temperatures are thus maintained at approximately 115° F., throughout continuous operation of the Moslo molders.

Beneficial effects of cooling hydraulic oil are the maintenance of viscosity, eliminating the possibility of breakdown and the prevention of harmful carbon deposits in pumps.



Rear of Moslo Molder, Cooler Circled

Young Radiator Company Heat Exchanger

Young Radiator Company Heat Exchangers are available for quick delivery in fixed or removable tube bundle models for fresh or salt water applications. High heat transfer rates per unit volume of space make Young exchangers the economical answer for simple cooling of oil or water, to cooling or heating of special liquids or gases.

For further details on Young Heat Exchangers see your nearest Young Representative, or write the Young Radiator Company, Dept. 445-B, Racine, Wisconsin.

NEW FIXED TUBE BUNDLE HEAT EXCHANGER CATALOG READY

A complete description of stock and specially engineered Young Radiator Company Type "F" Fixed Tube Bundle Heat Exchangers is given in the newly revised Catalog No. 1254. For your copy, write Dept. 445B, Young Radiator Company, Racine, Wis.

Young RADIATOR COMPANY

RACINE, WISCONSIN

Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY

Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

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We put Hydraulic Cylinders on a reducing diet

RESULT:

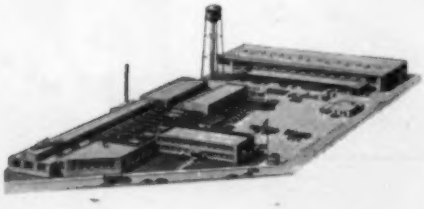
The New VICKERS® "Compact" HYDRAULIC CYLINDERS

For 2000 PSI Working Pressure

Everybody agreed that hydraulic cylinders were just too fat . . . took up too much space. So our engineers put them on a reducing diet. The result . . . these slim, powerful, "Compact" cylinders fit and work in spaces where the old type could not. It is part of Vickers long-time program of continuous improvement.

Among their many other features are: Multiple port positions. Spring-loaded synthetic-impregnated leather rod seal compensates for wear, assures long service. Piston seals are improved cup type. Tie rods are high tensile alloy steel. Adjustable integral hydraulic cushions are available. Comply with JIC standards. Conservatively rated for maximum working pressure of 2,000 psi. For further information, see Bulletin 54-68.

Waterbury Tool Division of Vickers Incorporated where "Compact" Cylinders are manufactured.



Ask for New Bulletin 54-68

VICKERS Incorporated

DIVISION OF SPERRY CORPORATION

1474 OAKMAN BLVD. • DETROIT 32, MICH.

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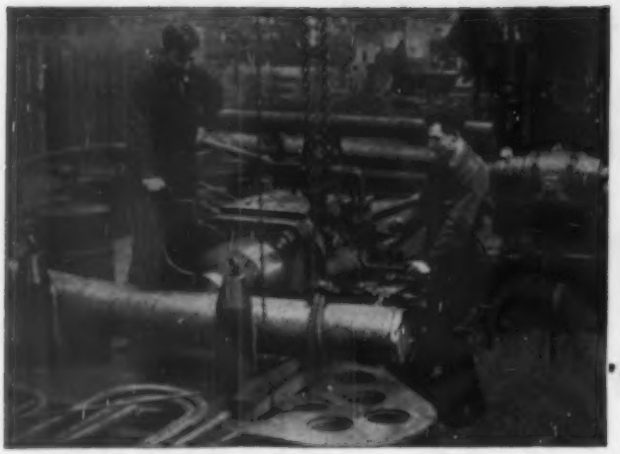
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



PIPE BENDING IN HOLLAND

NO LIMIT

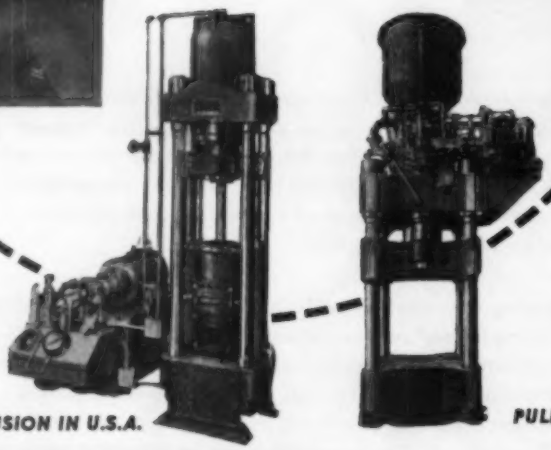
TO THE APPLICATION OF ELECTRAULIC HIGH SPEED PUMPS AND AUTODRAULIC CONTROL VALVES

All over the world, Electraulic high speed pumps and Autodraulic control valves (no solenoids) give consistent performance over a wide range of applications. A direct hydraulic system powered by Electraulic pumps and operated by the Autodraulic push-button control system is an independent unit, unaffected by the demands of other machines, giving any desired pressure at fingertip control—it cannot fail to give increased efficiency and economy in *your* plant.

FORGING IN SWEDEN

IN-LINE PLUNGER PUMP

Electraulic Twin Straight-in-Line Plunger Pump, mounted in a steel bed-plate tank.



EXTRUSION IN U.S.A.

PULP BALING IN CANADA.

ELECTRAULIC REGD. TRADE MARK

DIRECT HYDRAULIC SYSTEM

HIGH SPEED PUMPS

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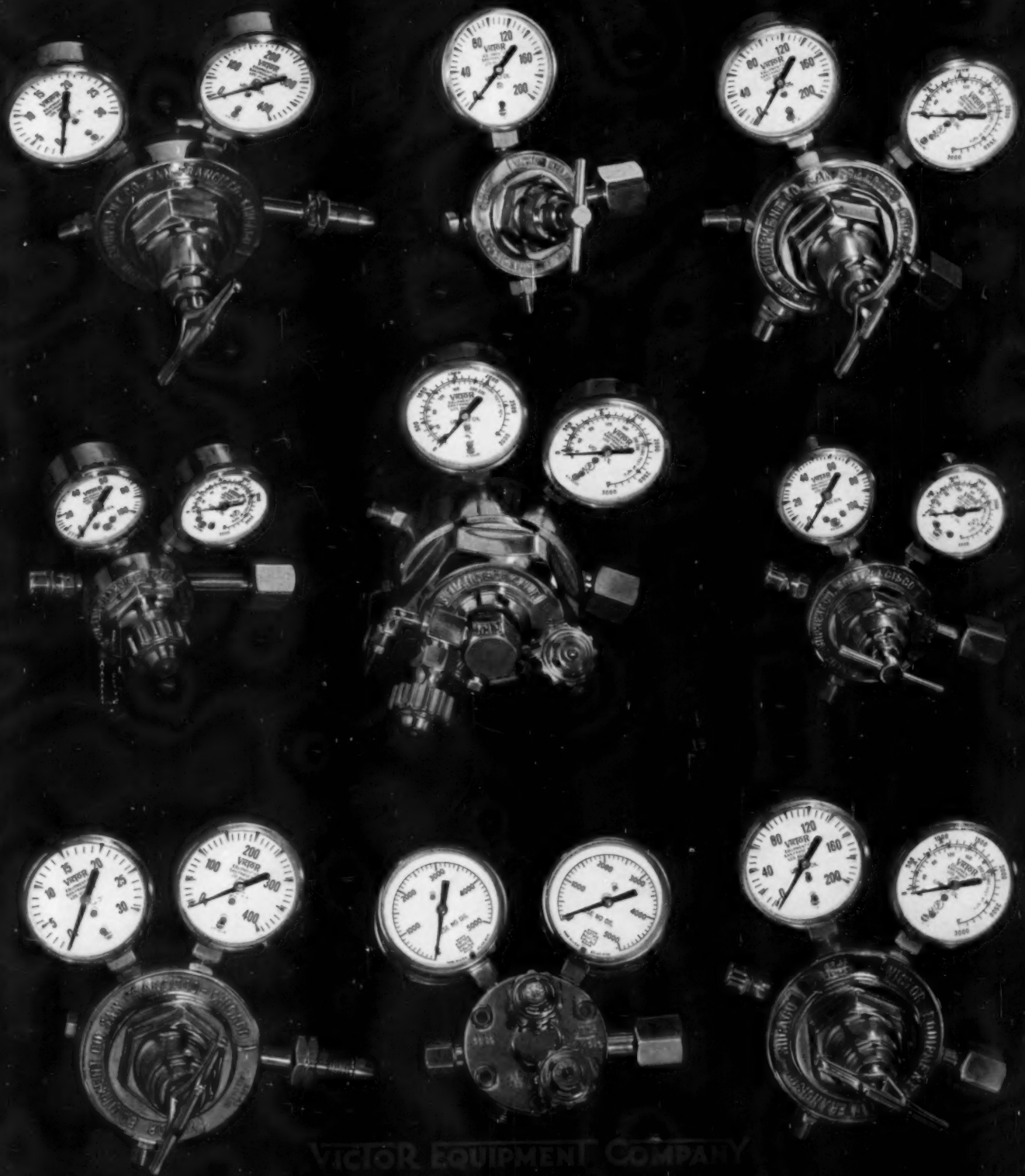

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"Compact design with a variety of porting made the WEBSTER Hydraulic Pump ideal for our job" ... says Robert E. Dickinson, Prod. Mgr., Mobile Drilling, Inc., Indianapolis, Ind., maker of the Jeep-mounted exploratory 3" to 6" earth auger illustrated

• Designed originally to drill test holes down to 120 feet in the coal fields, the Mobile Drill has opened up other uses where the soil substructure must be determined in advance.

• The WEBSTER 1-HCS Hydraulic Pump used on the B-27 Mobile Drill is mounted on a welded steel bracket and belted to the crankshaft sheave of a Jeep. It delivers 7 GPM against 1000 PSI at 1800 RPM to actuate a double-acting hydraulic cylinder which raises and lowers the rotary turntable of the spiral drill.

• The same compact design and convenient porting that makes WEBSTER Hydraulic Pumps so ideally suited to use on Mobile Drills is also available in the broad line of WEBSTER gear type pumps. These pumps are available for use on agricultural implements, industrial trucks, loaders, power steering, machine tools, construction and special machinery.

• If you have a hydraulic pump problem, you'll find WEBSTER eager to work with you on both design and test . . . at your plant or ours. WEBSTER has a lot to offer, so write today for a catalog containing illustrations, descriptions, typical performance curves, and pump data sheets.

OVER 100 STANDARD GEAR TYPE PUMP MODELS

CAPACITIES....1/6 to 30 GPM

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DRIVES.....Direct, gear, belt

Space-saving WEBSTER Hydraulic Pump fitted into tight quarters under Jeep hood

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ESTABLISHED 1909

MANUFACTURERS OF A COMPLETE LINE OF OIL HYDRAULIC PUMPS

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KENT OWENS TOLEDO, OHIO has this to say:

"we specify Snap-Lock Limit Switches and Namco Solenoids on all the standard and special machines we build because of their dependable controls with trouble-free long life"

L. F. Rothert, Director of Engineering
Machine Tool Division

NOTHING determines the efficiency of your production equipment, and the ultimate cost of its product, so much as the often hidden but vital controls that insure its split second precision, and elimination of down-time losses.

That's exactly the function and the guarantee behind Snap-Lock Switches, designed with separate sealed off mechanical sides, and of Namco "Stellite"-Weld Solenoids. Each is a patented product.

Built first to improve controls—"built with machine tool ruggedness"—for our own Acme-Gridley Automatics, these electrical devices are now specified as standard equipment by 90% of this country's machine tool builders alone. Army, Navy and Aircraft suppliers specify them used singly and in combination. Other uses in valves, clutches, switches and innumerable devices, number in thousands.

If you need to step up a cycle of operation—get rid of mechanical wear, save space and insure more dependable, continuous control of your production, ask our Engineers to help you "design one in" to your machine or process. Engineering specification catalogs—Limit Switches EM-51; Solenoid EM-52.

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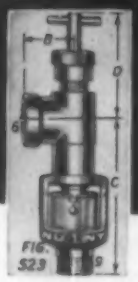
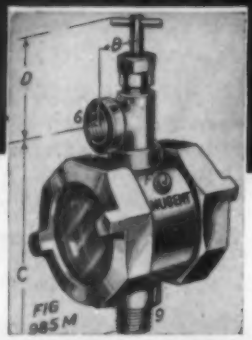
See...Don't Guess

Install NUGENT Sight Feed Valves for LUBRICATION CONTROL



13 models designed for working pressures to 125 psi. Sizes to ¾ inch.

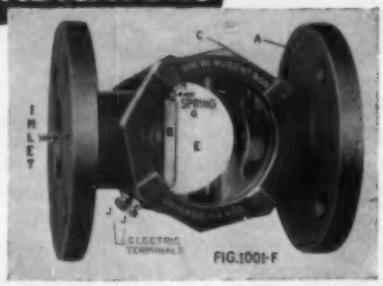


9 models for large machinery. "Swivel and lock" type for sight chamber adjustment to most convenient view position.

Medium size needle type with steel valve stem. 9 models. Sizes to ¾ inch.

WITH a Nugent Sight Feed Valve in your oil line, you can tell at a glance whether or not vital parts are receiving proper lubrication. Nothing is left to chance and there's no guess work involved. Oil flow through the valve is controllable from 2 drops per min. to 21 gals. per hour depending upon oil viscosity and valve model. All are vented to prevent air binding. Glasses and screens are removable for cleaning without interrupting oil flow.

SIGHT FLOW INDICATORS



Sight Flow Indicator available with tapped or flanged connections. Removable windows. Can be installed right or left hand or vertically.

ANOTHER NUGENT instrument for solving lubrication problems is the Sight Feed Indicator. Installed in a machinery oil system, this device sounds an alarm when oil is not getting to bearings. When oil is not flowing properly, Indicator "B" (See Fig. 1001-F) closes making contact with terminals "J". This sounds the alarm making it possible to locate trouble quickly, protect valuable machinery and save on costly down time.

For trouble free lubrication systems, write for descriptive bulletin on the Nugent Sight Feed, Sight Flow Indicator and other Lubrication Specialties.

Wm. W. Nugent & Co., Inc.

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LETTERS to the editor

Air-Oil Booster Pump

We have recently conducted an investigation to determine the most suitable type of hydraulic pump unit applicable to a rock drill boom mounting we manufacture. From point of simplicity and degree of control we have concluded that a direct acting, differential piston, air-oil booster pump would be ideal. The unit should be capable of about 2 gpm plus or minus .5 gpm at 1500 psi when operated on 80-100 psi air (or a 15-20.1 boost). It should be rugged, small in size (not over 12-15 inches long) and, of course, low in cost. We would appreciate any information you can give us on a pump to fit this application.

E. H. KURT,
Rock Drill Division,
Ingersoll-Rand Co.
Phillipsburg, N. J.

There are several manufacturers of air-boost pumps that might be suitable for a rock drill boom mounting. We suggest that you investigate the units offered by Sprague Engineering Corporation, 1144 West 135th St., Gardena, Calif.; Davies Brothers, 120 Wall St., New York City; and the Bee Line Company, 2501 North Lincoln, Davenport, Iowa.

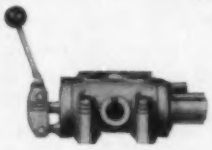
10,000 psi Circuits

I am designing an extra high pressure hydraulic system, for testing purposes, with the following specifications: working pressure 10,000 psi, tube size 1 inch O.D. and I would appreciate your advice on the following points: a) What material and wall thickness are recommended for the tubing; b) What fittings are adequate for this extra high pressure and who manufactures them; c) Manufacturers names and addresses,

Continued on page 38

"Why is it easy to plan Hydraulic Circuits using RIVETT VALVES?"

COMPLETE LINE



Hand, Foot, Cam, Solenoid, Pilot Operated

Sub-Plate Mounted, Solenoid, Pilot Operated

Flow Control, Check, Deceleration, Relief, Unloading, Sequence, Counter-Balance

1500-3000 P.S.I. | PISTON DESIGNS FOR ANY CIRCUIT

Sizes: 1/4", 3/8", 1/2", 3/4", 1", 1-1/4", 1-1/2"

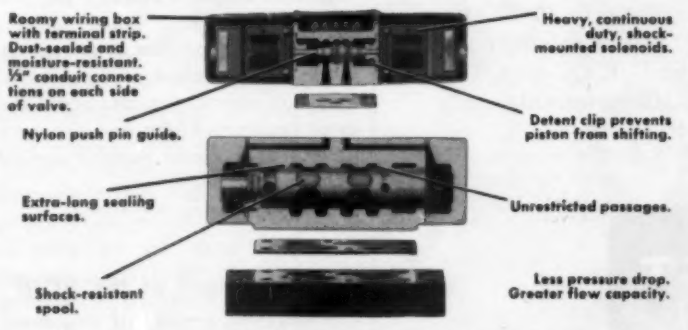
Actions: Standard, Spring Return, Spring Centered, Ball Detent

EXPERIENCED DISTRIBUTORS

"1st — Rivett's 190 standard models give me more latitude in engineering a circuit. This wide selection permits choosing the right type of valve for a more economical and efficient operation."

"2nd — My Rivett Distributor is experienced in hydraulic design. With his help I have been able to plan better operating systems."

QUALITY CONSTRUCTION


Roomy wiring box with terminal strip. Dust-sealed and moisture-resistant. ½" conduit connections on each side of valve.
Heavy, continuous duty, shock-mounted solenoids.
Nylon push pin guide.
Detent clip prevents piston from shifting.
Extra-long sealing surfaces.
Unrestricted passages.
Shock-resistant spool.
Less pressure drop. Greater flow capacity.

Sub-Plate Mounted, Solenoid, Pilot Operated Valve

INFORMATIVE LITERATURE

"3rd — I can count on longer life as well as the rated performance of Rivett Valves. They are designed and built for accurate circuit control."

"4th — Rivett valve catalogs are complete with specifications and drawings. Write for #204 and #260."

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RIVETT furnishes a complete power package

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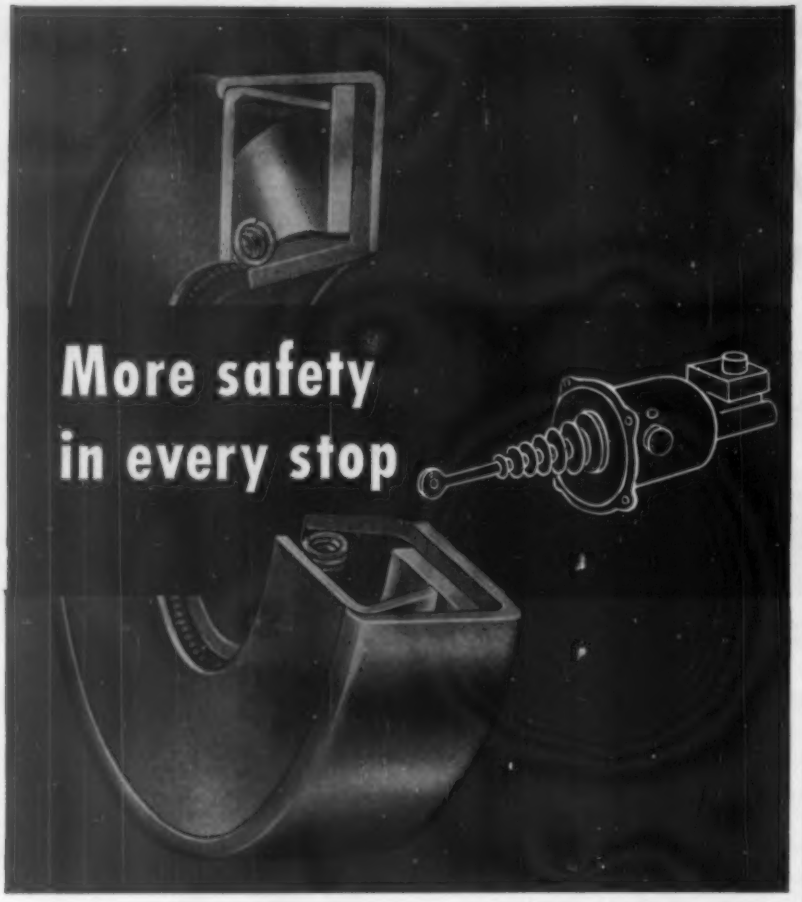
Member—National Fluid Power Association



C/R SEAL BACKS UP EXTRA BRAKING POWER

Every time you touch your pedal it must function dependably. In a well-known power brake unit a small C/R Oil Seal is doing a big job between the vacuum and hydraulic cylinders. It seals effectively on both sides, withstands pressures to 10 psi, and provides maximum flexibility to follow possible eccentricity up to .025". And there has never been a failure in the field. If your product must conform to equally high standards, consider C/R Oil Seals. For basic information let us send you a copy of "C/R Perfect Oil Seals."

C/R PERFECT Oil Seals

More automobiles, farm equipment and industrial machines rely on C/R Oil Seals than on any similar sealing device.

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1301 Elston Avenue OIL SEAL DIVISION Chicago 22, Illinois
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SIRVENE (Synthetic rubber) diaphragms, boots, gaskets and similar parts for critical operating conditions • CONPOR: Controlled porosity mechanical leather packings and other sealing products • SIRVIS: Mechanical leather boots, gaskets, packings and related products.

LETTERS to the editor

of extra high pressure hydraulic components such as relief valves, direction control valves, shut off valves, etc.

R. BURGAT
Montreal, Canada

We have sent you several suggested sources for tubing, fittings and valves. Your problem is not an easy one and will require special attention. As far as we know, no manufacturer of 1 inch O.D. tubing offers standard tubing that will stand 10,000 psi working pressure. Since it is normal that a burst pressure of at least four times the working pressure is desirable, a tube of 1 inch O.D. would require at least a 5/16 inch wall in a standard carbon steel tube. Because this would reduce the flow considerably, it is likely that it would be necessary to go to a larger O.D. to maintain the desired volume and velocity of flow. Stainless steel tubing would cut the wall thickness to approximately half and would also be special for pressures of this range.

Manufacturers of fittings recommend that fittings be welded in this pressure range. There are several manufacturers who make fittings that would be suitable for this range of pressure.

Your third question as to sources for hydraulic valves of comparable ranges of pressure creates about the same problem. These are also very limited and would require special units in most cases.

"Proceedings" of the NCIH

I would be grateful if you could advise me as to where I could obtain a copy of the "Proceedings" of the National Conference on Industrial Hydraulics" 9th and 10th anniversary meetings.

E. G. STRICKER,
Development Engineer,
De Havilland Aircraft Pty., Ltd.,
Alexandra, SW, Australia

Copies of the "Proceedings" of the ninth NCIH may be obtained

from the Secretary, National Conference on Industrial Hydraulics, Technology Center, Chicago 16, Ill. at $4.50 per copy. The "Proceedings" for the 1954 Conference (10th Anniversary meeting) will be available shortly.

Needs a "Decontrol Valve"

We are intending to install on one of our towboats a hydraulic pilot house control system. We want to make it possible for the engineer to manually take over control of the engines at any time. To do this, we need a decontrol valve which will by-pass the oil around the slave lock on both the reverse control and throttle systems simultaneously. We would like to learn of a source of supply for this valve.

W. E. GLISSMANN
Engineer-in-Charge
Corps of Engineers
Omaha District Service Base

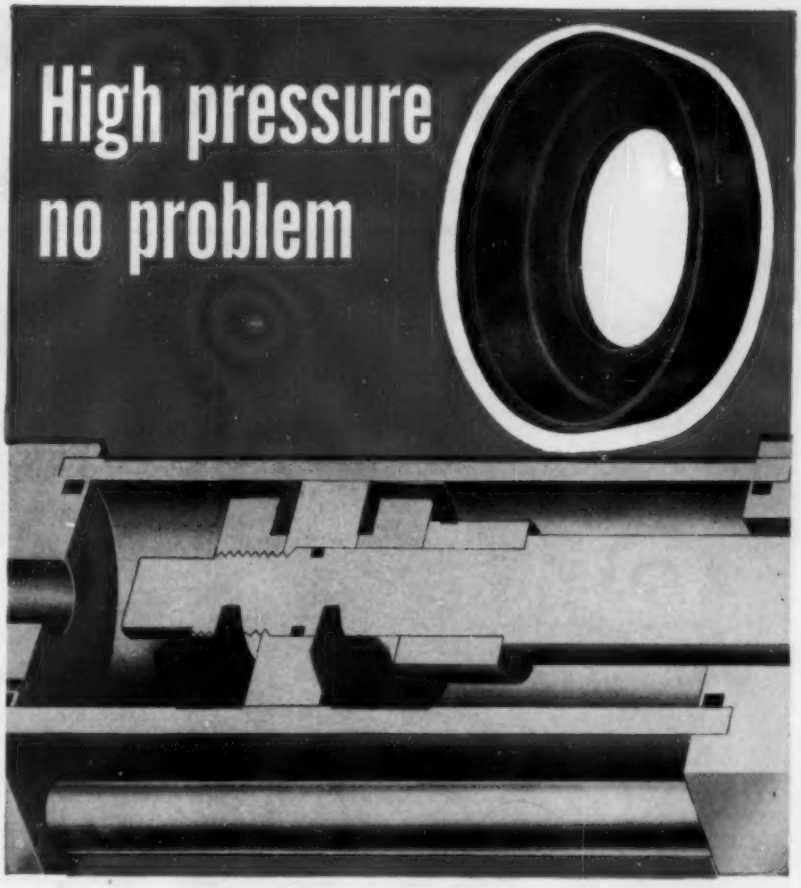
Usually these decontrol valves are simple globe type shut off valves. We've sent you a list of manufacturers. You may get some valuable ideas from the article on master and slave circuits in the November issue of APPLIED HYDRAULICS. *This article discusses a circuit which is similar to the one which you intend to build.*

Wants Basic Hydraulics

A few years ago, you ran a series of articles on "Elementary Applied Hydraulics" in your magazine. I kept this series against the time when they might become of value to us in actual hydraulic application, but unfortunately they were mislaid or destroyed. Can you replace them . . . or what can you suggest as a text that would be helpful to beginners in the art of hydraulic applications?

PAUL GENZMER
Gifford-Wood Co.
Hudson, New York

There are NO reprints or tearsheets available for the hydraulics course which we published. However, we have sent you a copy of the APPLIED HYDRAULICS *Data List which summarizes and gives the sources for available literature in the field. Readers wanting a copy of this Data List should write us.*



SIRVIS-CONPOR PACKS IN A BIG PUSH

Got a high pressure problem? Maybe we can help. Chicago Rawhide's Conpor impregnated Sirvis leather packings are doing an outstanding job at pressures up to 10,000 psi. They are insoluble in most hydraulic fluids and are compatible with a wide range of other oils, solvents and gases. Sirvis-Conpor packings do not score cylinders, do not "chatter." The impregnations have no true melting point and will operate from as high as 225° down to −65°F. Sirvis-Conpor packings have high tensile strength, excellent resiliency, and operate without undesirable leakage. No other sealing material combines these advantages with long service life at such low cost. Let C/R engineers show you how to solve your hydraulic and pneumatic sealing problems with Sirvis-Conpor packings. Send for "Report on Conpor." Write A. S. Berens, Chicago Rawhide Mfg. Co., 900 N. State St., Elgin, Ill.

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SIRVIS MECHANICAL LEATHER

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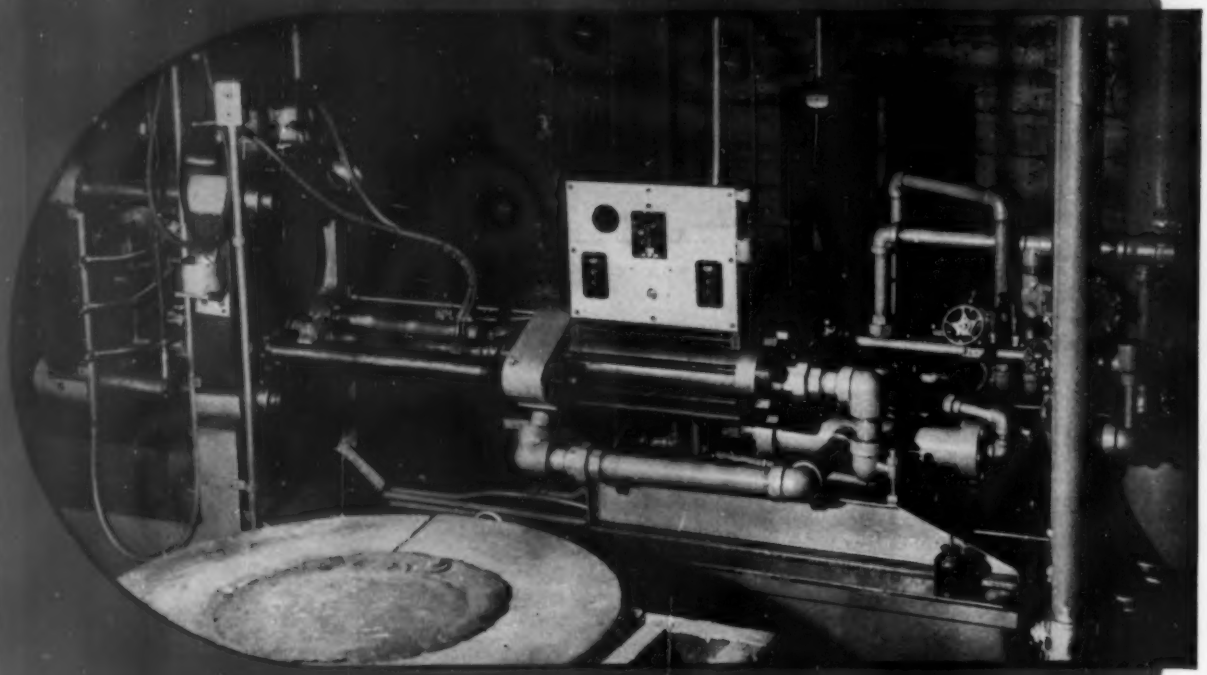
OIL SEALS: Shaft and end face seals for all types of lubricant retention and dirt exclusion • SIRVENE: (Synthetic rubber) diaphragms, boots, gaskets, and similar parts for critical operating conditions • SIRVIS: Mechanical leather packings and related products.

"AFTER 4 YEARS...



PERFECTLY CLEAN"

THE OPERATOR of this high-pressure die-casting machine told us about the excellent results obtained by using *Texaco Regal Oil R&O* as hydraulic medium—

"After four years of round-the-clock service, we found the original *Texaco Regal Oil* R&O still in perfect operating condition. It was absolutely free of sludge and the entire system perfectly clean."

Texaco Regal Oil R&O stands up like this in all types of hydraulic service. This is the oil that tests prove has *more than ten times the oxidation resistance of ordinary turbine-quality oils*—far greater ability to keep systems free from sludge, rust and foam.

Let a Texaco Lubrication Engineer show you how *Texaco Regal Oil R&O* can assure you smooth, uninterrupted hydraulic operation, longer pump and parts life, lower maintenance costs. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

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FOR ALL HYDRAULIC UNITS

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10 STEPS

TO SELECT A HYDRAULIC SYSTEM FOR

Automatic Machinery

• By James Tankard

1. Establish the required machine motions.
2. Set up a theoretical cycle time and prepare an operation sequence chart.
3. Select the proper type of circuit.
4. Choose the correct cylinders.
5. Select the necessary control valves.
6. Select the pump and electric motor drive.
7. Determine piping sizes.
8. Establish the electrical control system.
9. Complete the layout drawings.
10. Review the design—considering safety and maintenance.

• *On the following pages, Jim Tankard of Zagar Tool shows how they followed these 10 steps in designing the hydraulic system of a 24 station transfer machine. Each step is taken before any components are purchased.*

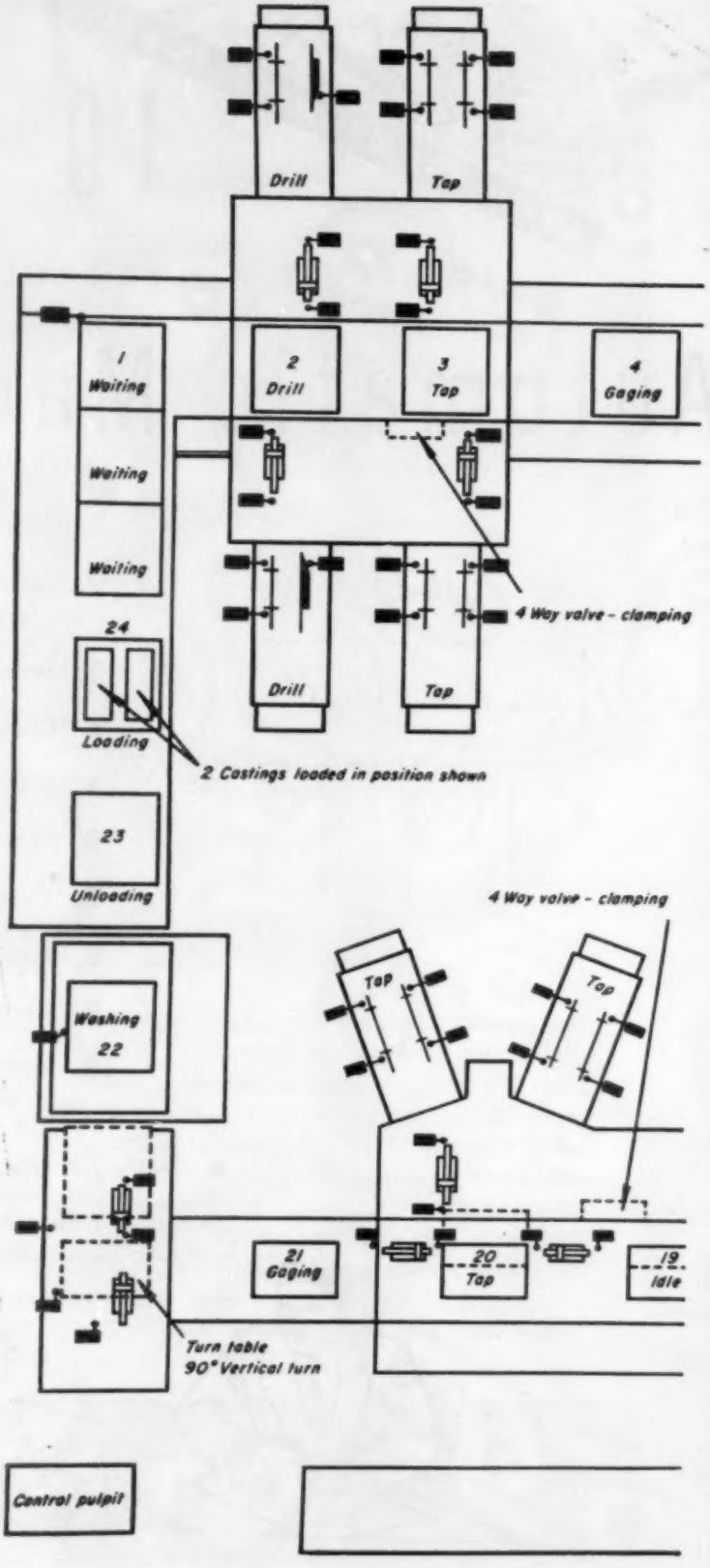
1 ESTABLISH THE REQUIRED MACHINE MOTIONS

"What must the machine do?" is the first question to be answered. The general layout drawing shown here is for a machine designed to drill and tap or ream many small holes set on close centers in a die cast aluminum typewriter frame. This frame is manufactured by the International Business Machine Corp. for their electric typewriter. From load to unload, operation of the machine as the part moves through 24 stations is entirely automatic. Two castings are loaded manually into a pallet. From this point on, cylinder operated transfer devices move the pallet. There are four drilling and four tapping stations; four stations are provided for gaging of parts. In the last station, before unloading, the parts are thoroughly washed. Idle stations are provided to allow ample room between units of the machine so that maintenance men can work without crowding.

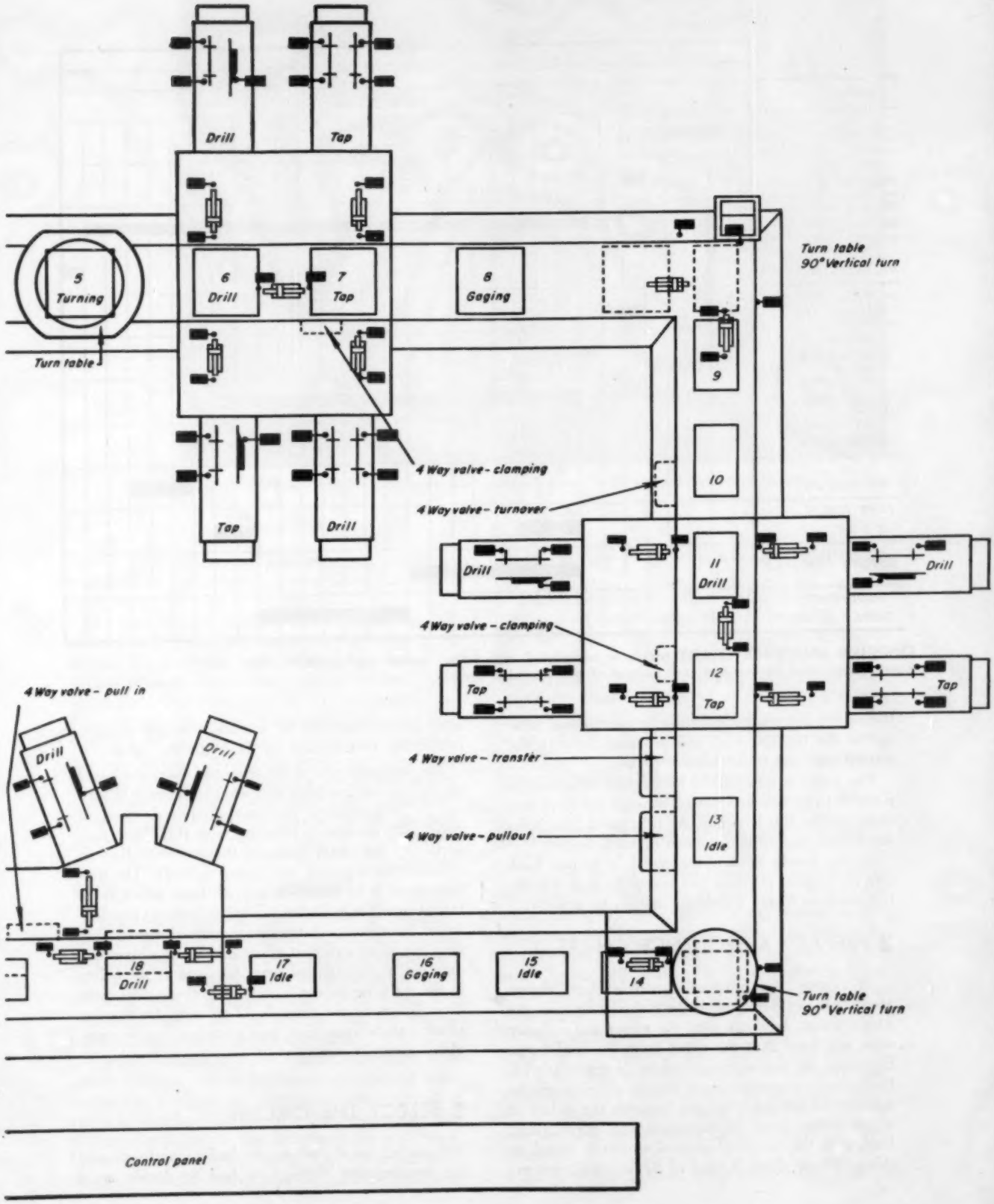
Various considerations caused us to design this machine in the form of a square.

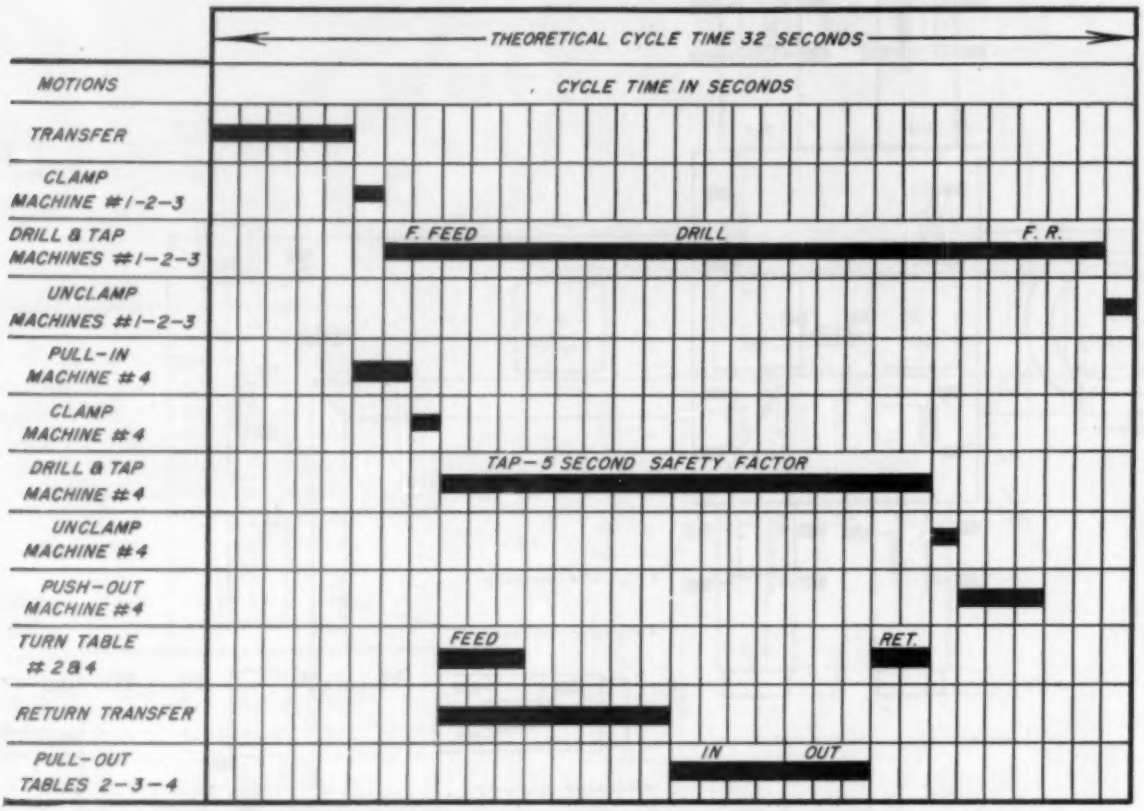
1. The advantage of loading and unloading at the same spot. Length of a straight line machine would have been about 100 feet.
2. Transportation limitations on size.
3. Available floor space.
4. Length of pipe between the pump and various valves.

The pallet is loaded on the fourth side and fed by gravity to the first corner. Picked up there by the transfer bar, it proceeds through the first machine onto a turntable. It is then



OVERALL PLAN DRAWING represents much of the design thinking. All the required motions are shown.


Drill
Tap
5
Turning
6
Drill
7
Tap
8
Gaging
Turn table
Turn table
90° Vertical turn
9
10
4 Way valve - clamping
4 Way valve - turnover
Tap
Drill
Drill
11
Drill
Drill
4 Way valve - clamping
Tap
12
Tap
Tap
4 Way valve - pull in
Drill
Drill
4 Way valve - transfer
4 Way valve - pullout
13
Idle
18
Drill
17
Idle
16
Gaging
15
Idle
14
Turn table
90° Vertical turn
Control panel



FINISHED SEQUENCE CHART which is completed only after pump and cylinder sizes are fixed, shows what happens at each instant of the machine cycle.

turned 90 degrees horizontally by mechanical linkage to the transfer bar, and proceeds through the second machine to the second corner.

The pallet is now turned 90 degrees in a vertical plane onto its side and moved through the third machine to the third corner. At this point, the holes are drilled, tapped and reamed in six sides.

At the fourth corner, the pallet is turned back into its original position and moves through a washing machine to the unloading station by gravity.

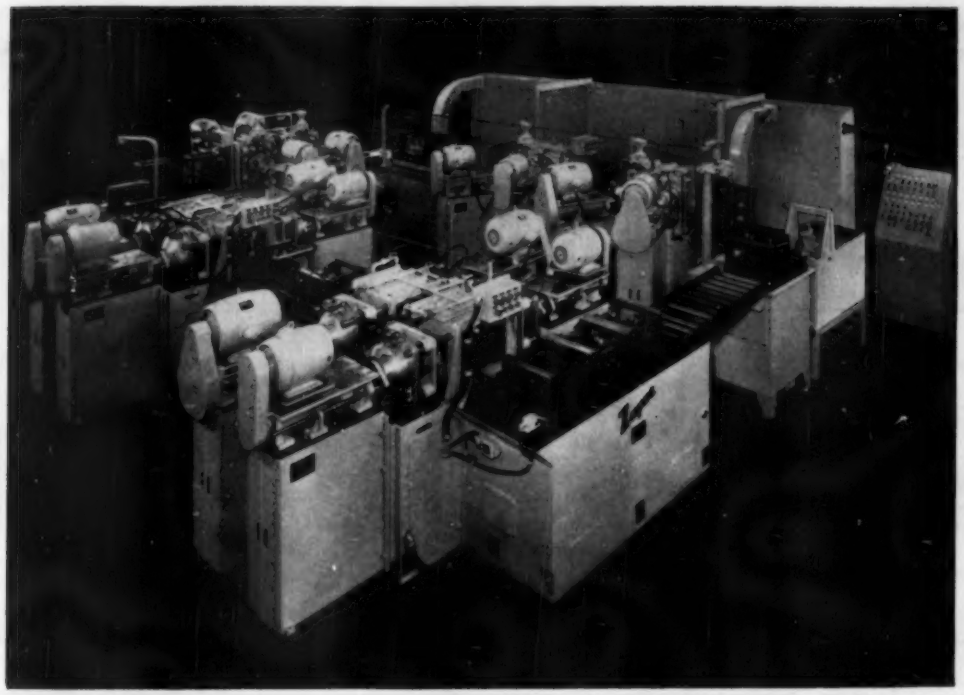
2 PREPARE A SEQUENCE CHART

Of course, the finished sequence chart shown above was not firmly setup on the first or even the fifth attempt. It is not until the pump and cylinder sizes are fixed that the chart is in its final form. However, an initial rough chart is very helpful. Preliminary sequence charts help to correlate all the motions of the machine and indicate the points at which valves must be energized and deenergized. Design of the electrical control circuit is based on this sequence chart. A total of 60 limit switches are used on the machine to actuate, through suitable relays, the 49 solenoids on the hydraulic valves.

The first attempts at the sequence chart are based on experience, research and what we hope will turn out to be intelligent guessing. Required speed of hydraulic cylinders is obtained from this chart, consequently the chart helps in the determination of cylinder sizes, piping and pump delivery. The ultimate goal is to establish a cycle time which is as fast as possible to do the job safely with no possibility of interference between machine elements. Putting this sequence chart along side the machine plan drawing quickly shows what happens at all points in the machine during a cycle. The theoretical cycle time shown on the chart is 32 seconds. On the finished transfer machine, two castings can be completed every 36 seconds.

3 SELECT THE CIRCUIT

Knowing what motions we had to perform, and the approximate timing, we had to decide on a



TWO HUNDRED PARTS per hour are completed on this 24 station automatic transfer machine.

circuit. From the maintenance standpoint, it is imperative that the hydraulic system be kept as simple as possible.

We have several hundred feet of piping in this system, so it is advantageous to have a low pressure system. We decided to work at 400 psi pressure. Use of low pressure eliminates most of the noise and surge from our lines. With a 400 psi system, the leakage, internal and external, can be kept very low. Components last longer and maintenance is easier. The low pressure system eliminates any possibility of using a hydraulic sequencing circuit and makes it necessary to control sequencing electrically. Electrical control results in greater flexibility and accuracy.

4 CHOOSE THE CYLINDERS

Four factors influence the bore of a cylinder: required force, required speed, operating pressure, available space. On the transfer and clamping circuit these factors are all favorable for selection of standard bore small size cylinders. Working within the pressure range of 400 psi, and knowing the size of the load, cylinder bores are computed.

The loads on the transfer cylinders are light. The pallets slide on rails on hardened and ground wear plates. The loads on the vertical indexing cylinders are somewhat heavier. They are the combined weight of the castings, pallets, and indexing table multiplied by the radius from the pivot point to the center of the clevis pin of the cylinder. None of these loads are heavy, so we are able to work with small diameter cylinders.

In clamping, the thrust loads of drilling are taken by the dead center design of our clamps. This also acts as a safety design in case a hydraulic line is broken.

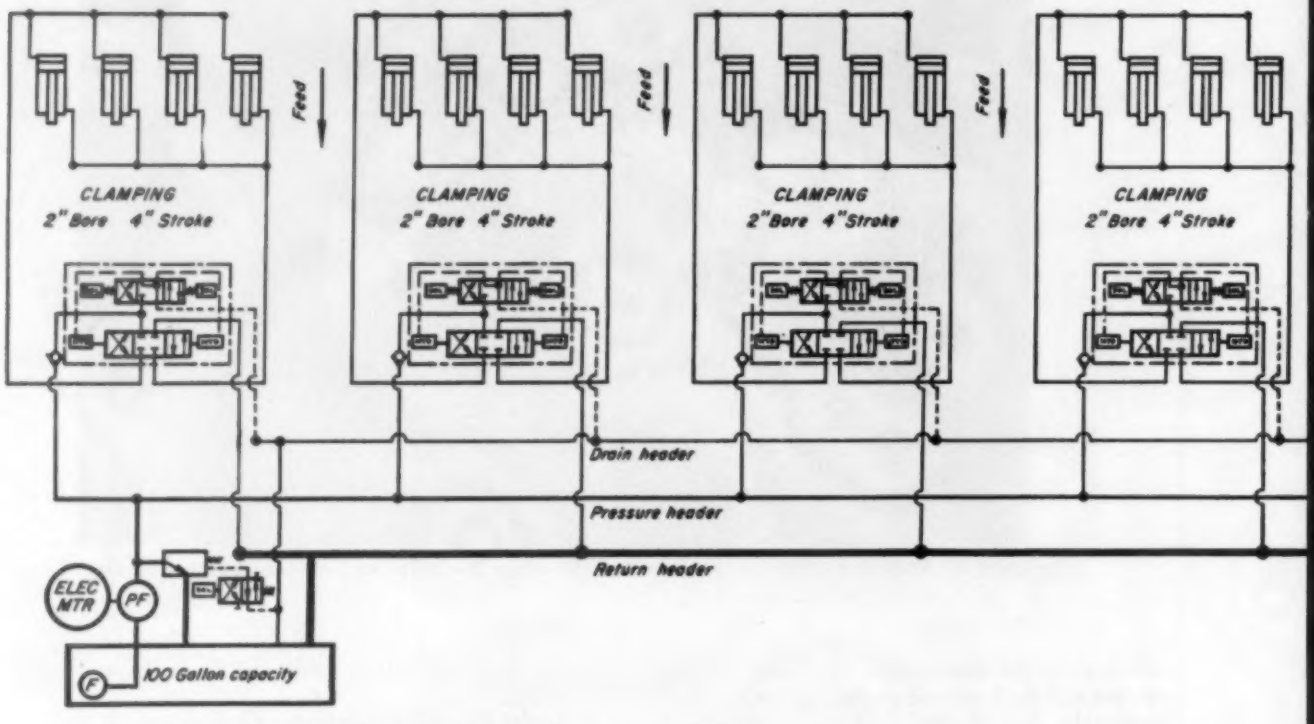
Of the 26 cylinders used, 22 have a 2 inch bore. The long stroke transfer cylinders have a 2½ inch bore to provide a proper bore to stroke ratio. Because of space limitation, one cylinder was made 1-9/16 inch bore. Cylinder strokes are determined from the machine layout drawings.

5 SELECT CONTROL VALVES

The next step is to select the proper type and size of valves. A relief valve is needed to control the maximum operating pressure of the system, and to dump excess oil. Some of the operations have to be roughly synchronized. Rough synchronization is obtained by actuating each group of cylinders with one 4-way valve. For close synchronization where the loads on two cylinders are quite different, a needle valve is used.

Knowing the size of the cylinders, the speed at which we wish to move, and which cylinders are serviced by each valve, the sizes of the 4-way valves are computed. Closed center valves are used to seal the individual circuit between the valve and cylinders.

Check valves, ¾ inch, are in each of the pressure



FINAL CIRCUIT DRAWING shows all the valving, piping, cylinders, pump and motor drive which are selected in each step of the design procedure.

lines between the pump and clamp control valves. The check valves prevent loss of clamping pressure due to fluctuating pressure in the main header as other cylinders go into action.

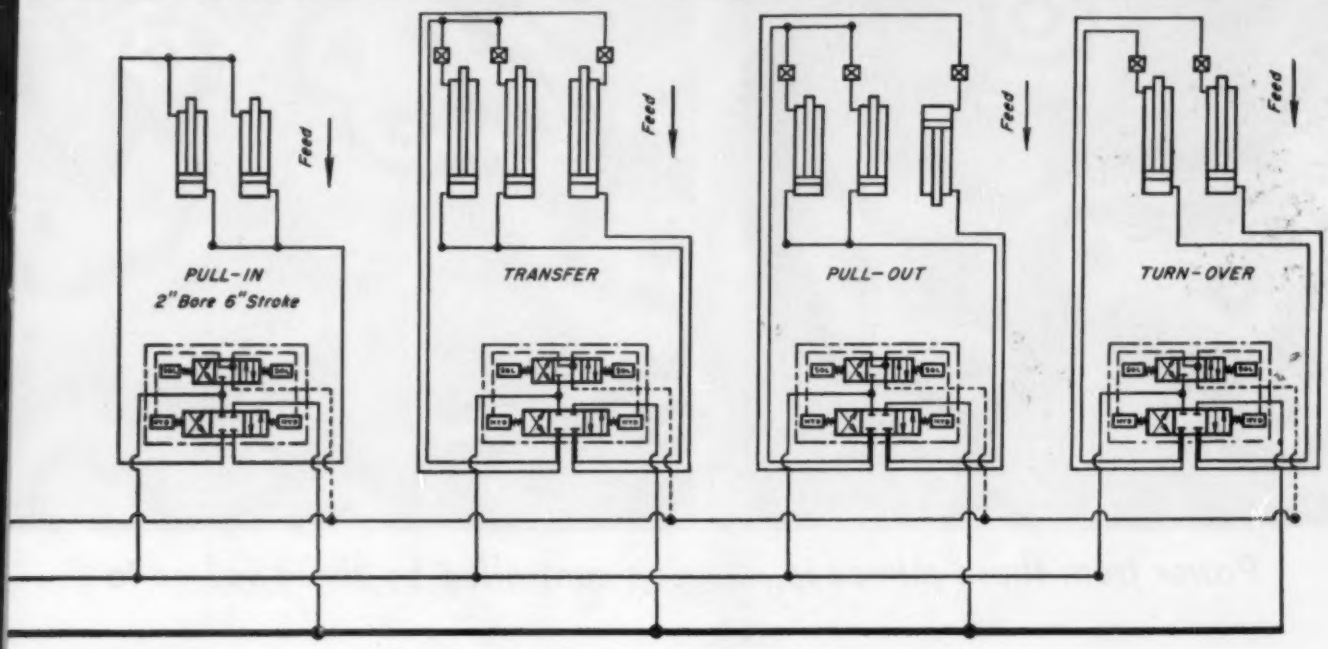
The only other valving is a solenoid operated vent valve to dump the pump when the machine is idle. The vent valve is controlled by a timer. If the operator left the machine or if a breakdown stopped the machine cycle, the timer will energize the vent valve after a predetermined time from the last cycle. The valve will then vent the relief valve which will in turn dump all the pump volume directly to tank at very low pressure.

6 SELECT PUMP AND MOTOR

All 26 cylinders in the transfer and clamping circuit are powered from one pump. (Each of the drilling and tapping machines is a separate independent package tied in electrically to the transfer line.) The pump must be able to operate at a minimum of 400 psi. To find the required volume, the sequence chart is used. It is seen that the maximum amount of oil is required during the sixth second when there is simultaneous action of the groups of clamps and the pull-in cylinders. A fixed displacement vane type pump capable of delivering 40 gpm at 0 psi is used. A relief valve limits maximum system pressure to 400 psi. Selection of the drive motor horsepower depends on pump delivery and pressure. A 40 gpm pump developing 400 psi requires about 10 hp. A totally enclosed fan cooled 10 hp motor is used to provide maximum protection and dissipation of heat.

7 DETERMINE PIPING

Pressure oil is pumped into a large 1½ inch x .065 wall main header tube which runs around three sides of the machine to a dead end. From this main header, oil is piped to eight double solenoid controlled, pilot operated 4-way valves. Return oil from the cylinders flows to a 1½ inch standard pipe return header. The return header is made larger than necessary to minimize any back pressure in the return line. All valves that need draining are drained into a separate ¾ inch standard pipe drain header which goes straight to the tank. Line sizes are



determined by flow rates and desired oil velocities. The hydraulic drawing indicates all the pipe sizes used in the circuit. Flow to each cylinder was considered so that pipe sizes are large enough to keep oil velocities at about 10 fps in all pressure lines.

8 ESTABLISH ELECTRIC CIRCUIT

The electrical control system is derived from the sequence of operation chart. No motion is started until a signal has been received (through limit switches) to show that the motion is safe. Sixty limit switches, carefully placed, send signals to the 49 solenoids on the valves to control their movement. These are also tied in with the solenoids and limit switches mounted on the 16 self-contained units that actually do the drilling.

For example: The vertical index table on the corner cannot index until a pallet (by contacting a limit switch) has signalled the main control panel that it is ready to be turned; nor can a pallet enter the index table until the previous pallet has signaled that is has left.

9 COMPLETE LAYOUTS

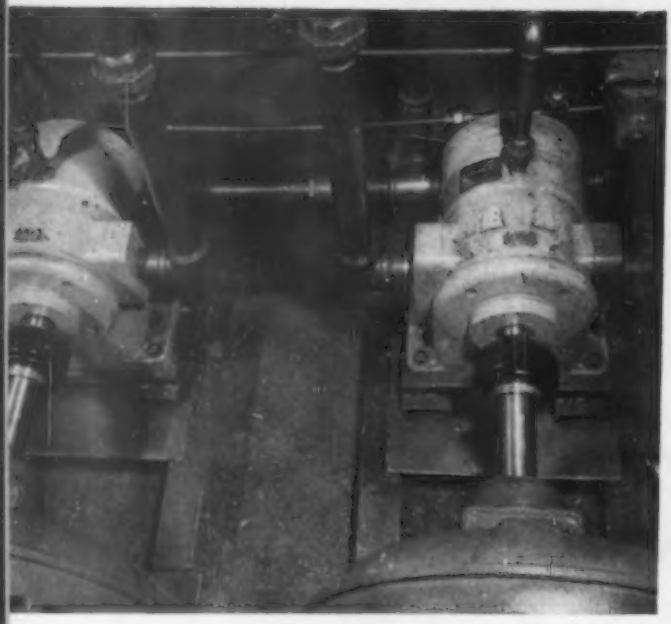
As we progressed, we were making complete layout and assembly drawings. Layout drawings at each cylinder operation show what type of cylinder mounting is needed. For example, clevis type mounting is needed for the turnover cylinders. At one corner, it was found that space limitations made it necessary to keep the piston rod stationary and transmit motion through the cylinder. Panel mounted control valves were selected to provide the greatest rigidity and accessibility.

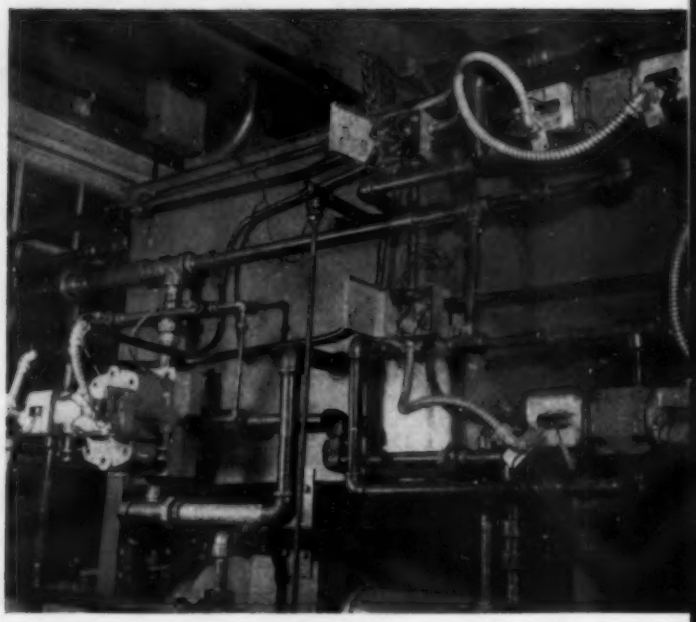
10 REVIEW FOR SAFETY

The final step is to make a complete review of the whole situation from the standpoint of operation and maintenance with safety in mind. We ask ourselves, "What will happen if a drill breaks? What will happen if someone drops a wrench into the works? What happens in case of a power failure—or a limit switch sticks? How can we make it easier to service the valves and cylinders?"

If our selection of components stands up under this review, purchase orders for all the components can be issued.

These ten steps, along with the drawings, tell you briefly how the hydraulic system on this automatic machine was built. They represent many weeks of planning and work before a single cylinder could be bought. While we have listed the ten steps as a sequence, many of them overlap and were worked out simultaneously. For a successful design all ten steps must be taken. ▼▼▼





Power from these pumps is . . . . . controlled by these valves to . . . .

This design differs from a conventional press because fixed displacement pumps are used and no large prefill valve and line are in the circuit

5000 PSI HYDRAULIC COMPONENTS

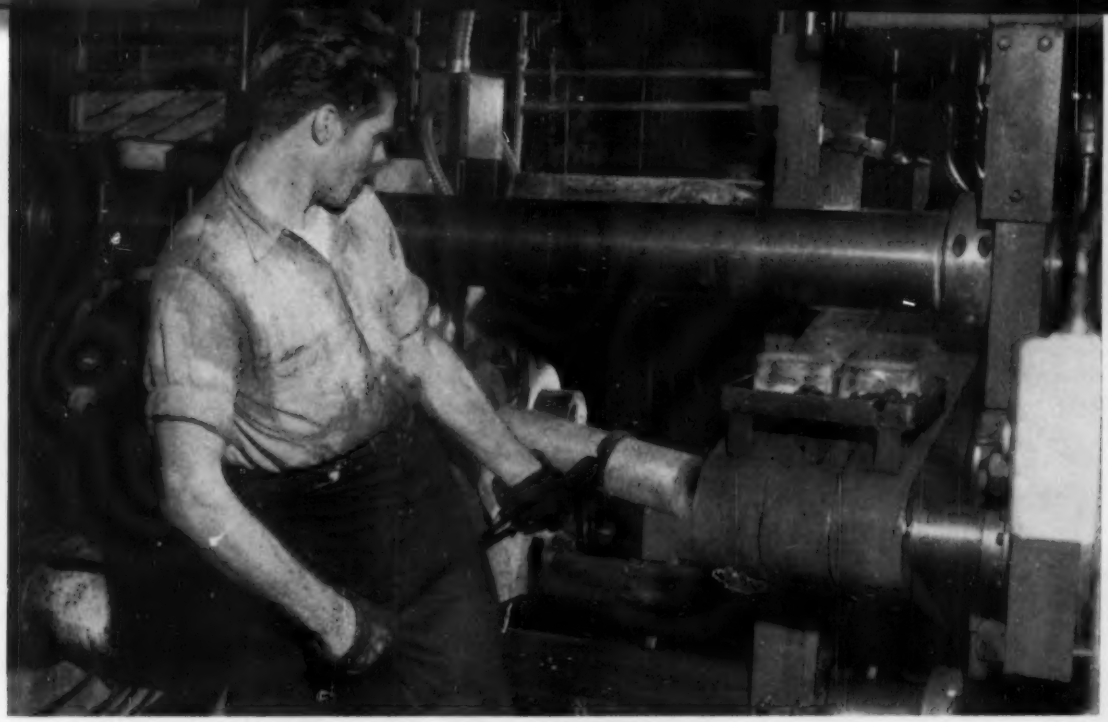
simplify extrusion press design

• By L. R. Hoffman

CIRCUIT design on the 1000 ton press built by the X-Press Company differs considerably from other presses of that size. The circuit is simpler and makes possible lower construction costs. Availability of pumps and valves which will continuously develop and control oil hydraulic pressures up to 5000 psi permits this design. Also the acceptance of certain limitations in speed and flexibility of operation allows the use of this circuit.

Unlike other extrusion presses, this design does not include a large prefill valve with the usual 8

L. R. HOFFMAN, *General Manager, X-Press Company, Beloit, Ohio.*



. . . . . extrude billets on this 1000 ton press

inch diameter line between the reservoir and the main ram. Continuous extruding pressure of at least 4000 psi is supplied by two fixed displacement 35 gpm, 5000 psi pumps instead of variable delivery pumps which are common to most designs. These differences play a large part in reducing the overall cost of the machine.

SHORT ADVANCE STROKE

The two pumps supply the volume and pressure for the operation of the main ram, the pull-back cylinders and the container and shear cylinders. To one who is familiar with conventional press design, the absence of a prefill system is most unusual. Like most 1000 ton presses, this machine has a 27 inch diameter main ram and two 8 inch diameter pull-back cylinders. On this press the pull-back cylinders are used to rapidly return the main ram. There is a 3 inch rapid advance stroke, and a maximum squeeze stroke of 18 inches.

Because there is no prefill directly from the tank to the main ram, the maximum rate of travel is governed by the delivery of the pumps. Since the approach stroke is only 3 inches it was felt that the added speed obtained by prefill did not justify the expense of a large prefill valve and line. During the long 21 inch return stroke, a 1½ inch dump valve is used to open the main ram to tank to speed the return.

The job this extrusion press performs is the same as any comparable 1000 ton press. Cylindrical shaped billets are manually loaded into the metal container on the press. With hand levers and push-buttons, an operator controls the movements of the main ram, pushing the billet into the die and extruding the shaped metal. The butt shear then knocks the butt off the die and the main cylinder is reversed to receive the next billet.

The operator sitting at the control panel, can select either one or both pumps to deliver the necessary volume requirement to suit billet extrusion speeds. Required extruding speeds vary from 15 to 35 ipm depending on the shape of the part being extruded. Maximum speed is obtained when both 35 gpm pumps supply oil to the main ram. A by-pass flow control valve permits varying the extruding speeds.

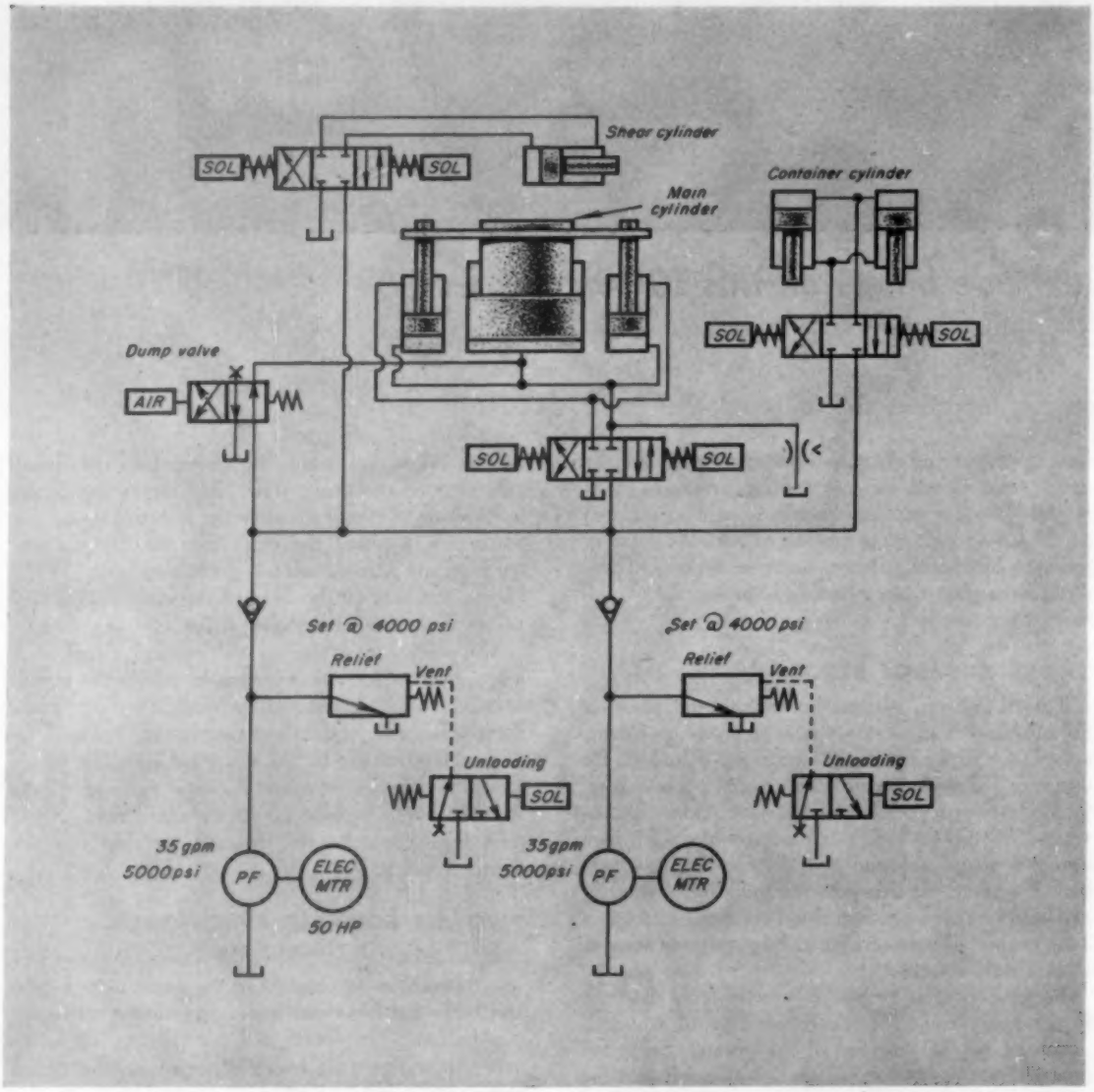
TWO AIR POWERED FUNCTIONS

In addition to controlling the pumps, the operator controls all the movements of the press from a control table that has three levers and all the necessary pushbuttons. The levers are for the two air actuated operations. One controls the main ram dump valve. The second air powered operation lifts the billet pushing stem to permit loading, and then lowers the stem after the billet is in place. This operation keeps the required advance stroke of the main ram down to 3 inches before the billet is contacted. Pushbuttons energize and deenergize the solenoid valves to move the container back and forth;

move the shear up and down; move the main ram in and out; to operate the unloading vent valves and to start and stop the pumps.

Each of the pump relief valves is connected to a 3-way solenoid operated valve used as a vent valve. When the operator wants to vent the flow from either pump to the tank, he pushes a button shifting the 3-way valve connected to the particular relief valve. Check valves in the lines prevent any back feed of oil when one or the other pump is used alone.

The pumps volume is delivered through a 1½ inch double solenoid controlled, pilot operated 4-way closed center valve. This valve controls direction of the single acting main ram and the double acting pull-back cylinders. One of the important functions of this 5000 psi 4-way valve, which is accomplished by spool design, is to reduce shock to a minimum. ▼▼▼



EXTRUSION PRESS MAIN RAM and pull-back cylinders are powered by two 35 gpm pumps. Solenoid operated vent valves permit using each pump separately or both together. An air actuated dump valve operates during the opening of the press to provide a 1½ inch return line for the large volume of oil coming from the main ram. Speed regulation during extrusion is obtained by cutting out one pump and by adjusting a bypass flow control valve. An operator sitting at a control pulpit actuates operations by push-button. The 4-way control valves are pilot operated-solenoid controlled. A special spool in the main 1½ inch control valve minimizes shock during press reversal.

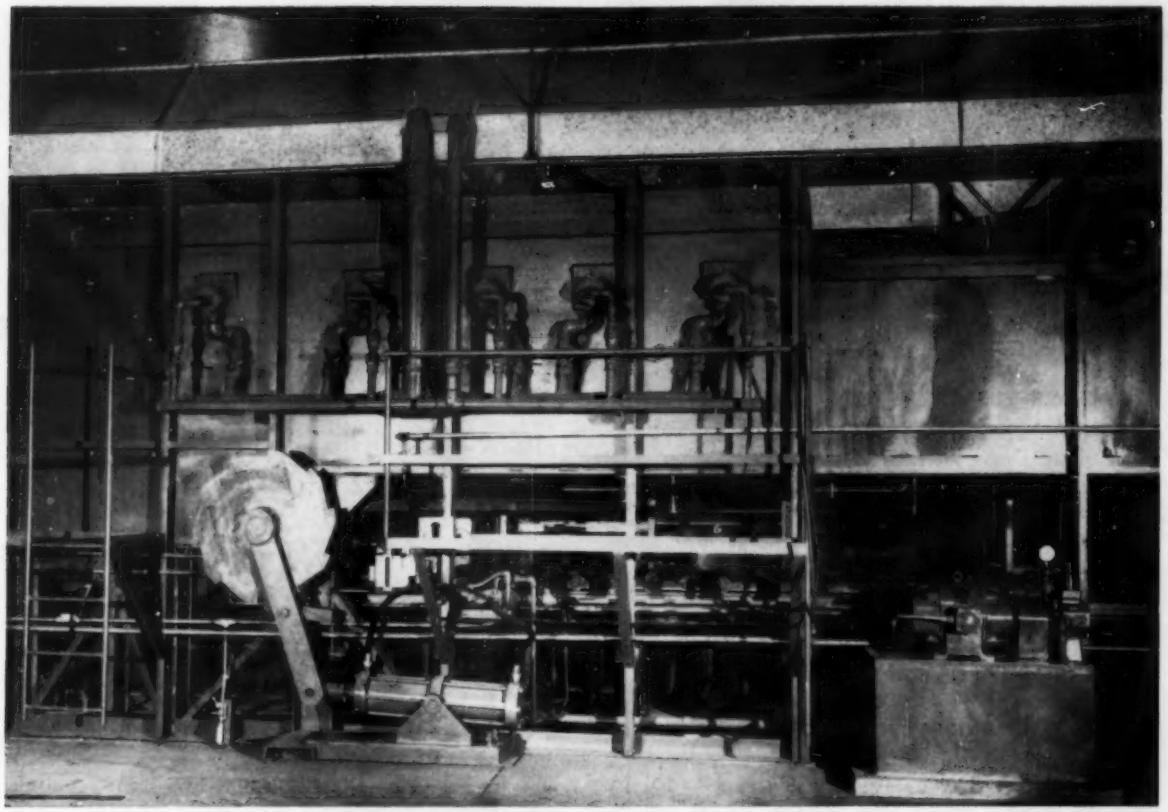


FIG. 1. TRUNNION MOUNTED cylinder drives the ratchet type indexing mechanism at the drive end of a shell normalizing and cooling conveyor. The power package includes a 30 gpm vane type pump driven by a 7½ hp motor.

LOADING and INDEXING MECHANISM

. . . for conveyorized parts

● By Carl Demian

HYDRAULIC cylinder operated devices provide a compact, positive and often automatic means of loading and feeding parts through industrial furnaces. In many industries, when work pieces are carried between operations on conveyors, heat treat operations become a part of a production line. Typical of such a line is the production of shell projectile forgings.

CARL DEMIAN, *Chief Draftsman, The Gas Machinery Company, Cleveland, Ohio*

Engineers at The Gas Machinery Company, Cleveland, have developed and built heat treat furnaces used in making gun shells. As part of this complete design, they had to provide the loading and indexing system which carries each shell into and through the furnace. Figure 1 shows the drive end of a shell normalizing and cooling conveyor. This photo clearly shows the cylinder powered ratchet and pawl arrangement which indexes the work through the chamber. A layout drawing, Figure 3, shows some of the mechanical details

for both the feed and index.

This mechanism is extremely simple and positive and requires a minimum of maintenance. The motions which are developed are common to many machines, consequently this hydraulic system is being used successfully in very many industries.

The trunnion mounted loading cylinder has a 2 inch bore and a 20 inch stroke. As it moves through its stroke, a linkage, tied to the piston rod, applies straight line motion to feed the four shells into four carrier arms on the conveyor.

MOMENTARILY ENERGIZED VALVES

A 7 inch bore 28 inch stroke, trunnion mounted cylinder powers the ratchet type indexing device. Oil is supplied to the two cylinders by a 30 gpm pressure compensated vane pump driven by a 7½ hp electric motor. Directional control for each cylinder is provided by a double solenoid, pilot operated, two position 4-way valve. Use of momentarily energized solenoids makes the electrical circuit very simple. Operated from 110 volt supply, one pushbutton and three limit switches provide the entire control.

With four shells loaded against stops on the charging end of the conveyor, the operator presses the pushbutton to energize the "forward" solenoid on the load cylinder valve. The load cylinder moves forward to push the shells onto the shell holders. At the end of the load cylinder stroke, limit switch LS-2 is closed to energize the "forward" solenoid on the index cylinder valve. The shells are now indexed into the first station on the conveyor. LS-3 is closed at the completion of the index cylinder stroke to energize the "return" solenoid on the load cylinder valve. With the load cylinder fully retracted, LS-1 is closed to cause reversal of the index cylinder. The operator then initiates the next cycle by again pressing the pushbutton. No holding relays are needed in the control circuit. Cylinder speed is regulated by globe valves located in the pressure line to each directional valve. ▼▼▼

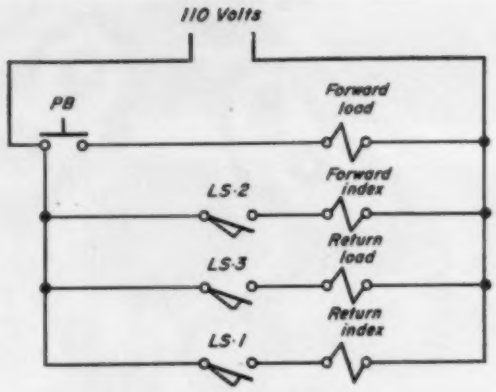
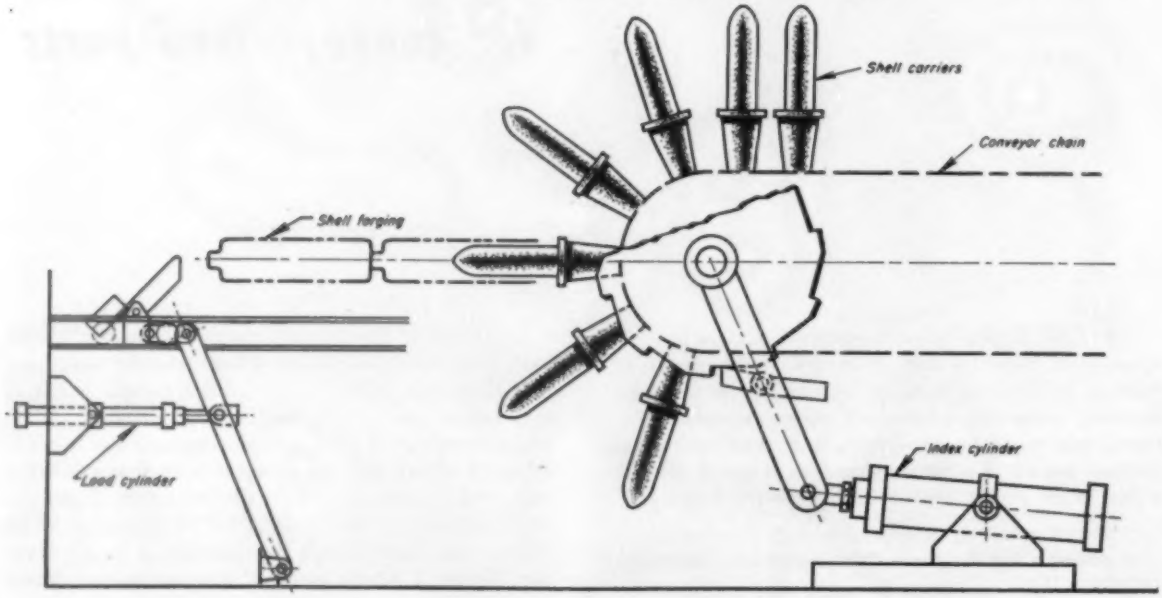


FIG. 2. TWO DOUBLE SOLENOID 4-way valves are controlled by this simple electrical circuit. Valve shifting is accomplished by momentarily energizing each solenoid.

FIG. 3. LOAD CYLINDER is located on the centerline of the furnace. Through a linkage, 4 shells are pushed into the shell carriers as the load cylinder extends for its 20 inch stroke. Trunnion mounted cylinders connected with flexible hose permit free movement.



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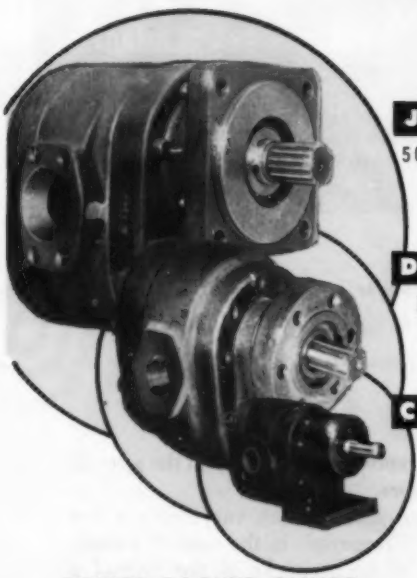

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WHAT KIND OF POWER FOR AIRCRAFT ACTUATORS?

Analysis of weight, size and overall efficiency helps designers to choose between hydraulics, pneumatics or electricity. Often a combination of the three are used on one aircraft.

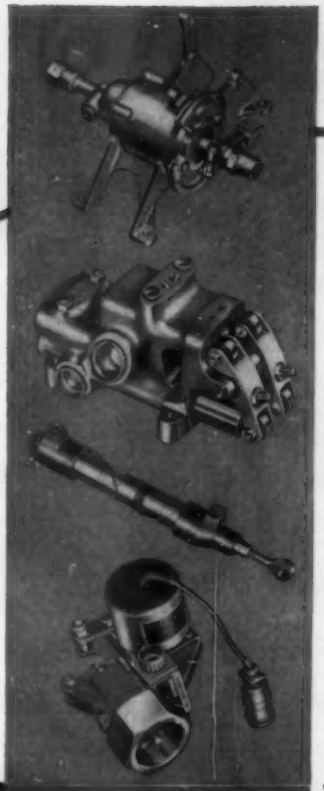
• By Robert C. Treseder and Howard M. Geyer

THE work that must be expended to actuate adjustable flight surfaces and to operate the landing gear, bomb doors, and other movable structures on aircraft often exceeds pilot capabilities. At the same time, the increase in physical size of aircraft during recent years has all but ruled out mechanical transmission systems. To provide for power amplification and to eliminate mechanical links, the aircraft-design engineer uses a multitude of remotely controlled actuating devices, known more simply in the aircraft industry as *actuators*.

The work of an actuator can vary from a few hundredths of a horsepower, in the case of a cowl-flap actuator, to 10 hp or 20 hp in the case of a large landing-gear actuator or a flight-surface actuator for a high-speed airplane.

When comparing the three types of power-transmission fluids—electric, hydraulic, and pneumatic—and the type of generation, transmission, and actuation that may be used, a multitude of variables at once becomes apparent. To simplify the presentation in this article, one very controversial point of

ROBERT C. TRESEDER, *chief engineer, and* HOWARD M. GEYER, *chief product research engineer, Aeroproducts Operations, Allison Division, General Motors Corporation, Dayton, Ohio.*



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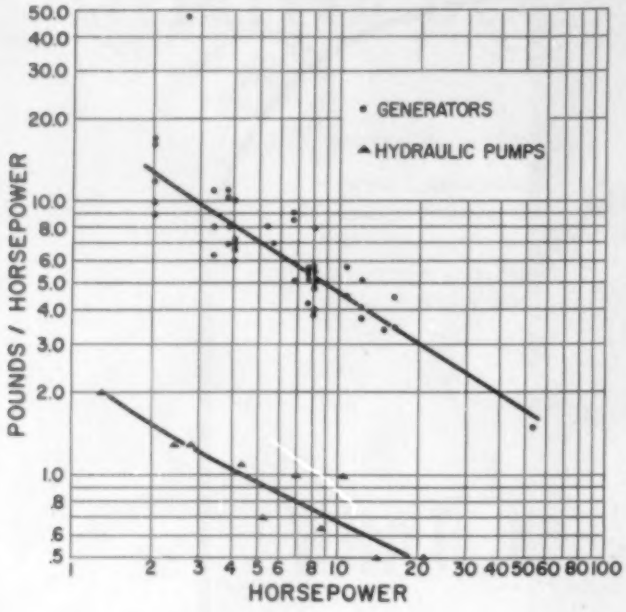
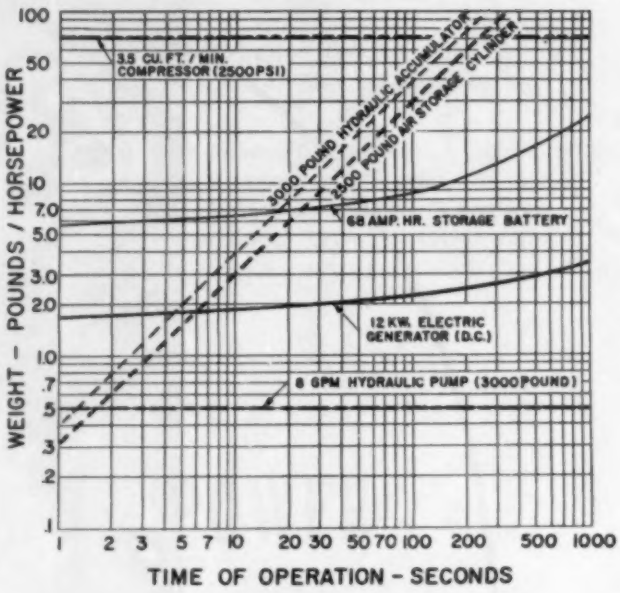


1 COMPARING THE POWER SOURCE



2 COMPARING POWER STORAGE DEVICES

comparison is avoided entirely. That point is reliability. Improvements are being made so rapidly in each of the power-transmission systems that statements made today on reliability would be out-of-date and possibly incorrect in a few months.

The comparison of power-transmission systems is made, therefore, on the basis of weight, size, and overall efficiency. It is appropriate to examine (a) the generation of the power, (b) the storage of the power, (c) the transmission of the power, and (d) the utilization of the power by the actuator.

POWER GENERATION

A-C and D-C Generators

Electric generators for aircraft have become fairly well standardized over the past few years and it is possible to obtain from the manufacturers of such equipment rather consistent data on both weight and efficiency. Figure 1 shows a plot of specific weight—that is, pounds per horsepower—versus horsepower for both d-c and a-c generators. These data can be plotted logarithmically as almost a straight line. Note the trend of reduced specific weight as horsepower is increased. This may be somewhat misleading, as the gains made in the large generators are not due to size alone. The larger generators have been built in later years and reflect improvements in insulation as well as the effects of higher operating temperatures, blast cooling, and higher drive speeds. Perhaps the curve should show a distinct leveling off at higher horsepower values.

There is a definite reduction in weight of the a-c generator over the d-c version. This is especially true in the larger generator sizes where the specific weight appears to level off at 20 lb per hp. The short-term overload capacity of an electric generator for a period of as much as 5 min is approximately 125 per cent and this allowance should be made in selecting a generator for most actuator requirements. The weight and the constant-speed drive, of course, penalize the a-c generator. The requirements of a constant-speed drive vary between piston engines and gas turbines. The latter type permits a smaller variation between normal and maximum speeds. The overall efficiency of the generator shows an improvement within both the a-c and d-c types with an average value of 73 per cent for the smaller sizes and a mean of 83 per cent for the larger sizes.

Hydraulic Pumps

Figure 1 also shows a plot of the specific weights of 1,500 psi and 3,000 psi hydraulic pumps of the engine-driven types. Again, there is much the same trend as the electric generators. Since there is a wide variation in the types of hydraulic pumps and in the

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Hydraulic ram for injection molding press leaked excessively, using ordinary hydraulic oil. Make-up ran approximately 8 gallons per week.

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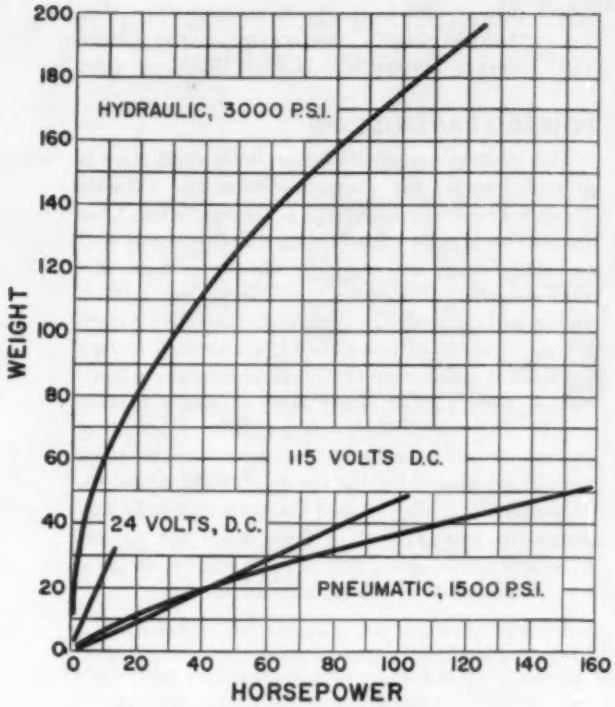
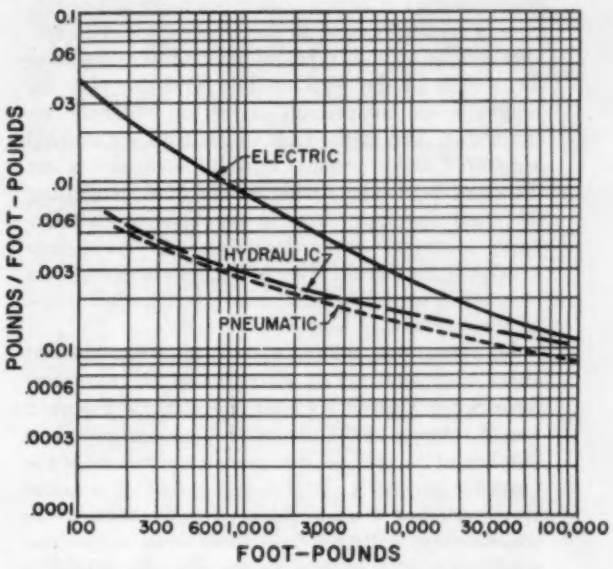


3 COMPARING TRANSMISSION LINES



4 COMPARING THE ACTUATORS

associated valving required to maintain the desired flow, it is more difficult to establish the mean curve. As is to be expected, the higher pressure pumps show a lower specific weight because the delivered horsepower of a constant displacement pump varies directly with pressure. In a constant pressure system, the hydraulic pump has very little over-load capacity as far as output horsepower is concerned. The specific weight of the 1,500 psi pump has an asymptotic value of 1.0, while the asymptotic value for the 3,000 psi pump is approximately 0.5.

The overall efficiency (volumetric plus mechanical) of a hydraulic pump at rated load does not differ greatly from that of an electric generator. Values of 75 per cent for small sizes to values as high as 90 per cent for larger sizes may be obtained. The part-load efficiency, like that of the electric generator, is lower than the full-load value.

Pneumatic Compressors

There are less available data concerning high-pressure pneumatic compressors for aircraft use than there are for generators and pumps. The high-compression ratio needed, especially for high-altitude operation, requires the use of several stages. For that reason, high-pressure compressors are not built in as large sizes as are either the hydraulic or electric generators. The specific weight of one make of compressor varies from 186.5 lb per hp in the 0.016-hp size to 40.1 lb per hp in the 0.523-hp size. The pneumatic compressor also has a lower efficiency than either of the other two.

POWER STORAGE

Aircraft actuators are used intermittently, and the integrated power demand of a series of actuators is so small that power storage appears, at first glance, to be attractive. Electric energy for aircraft is stored in much the same way that it is for automobiles. The lead storage battery for aircraft use, therefore, is only a fraction lighter than the automobile battery for a given energy storage, and storage batteries built by different manufacturers are based on standardized design procedures.

The ability of a storage battery to deliver its stored energy is dependent upon the rate at which it is to be delivered. Increasing the rate drastically reduces the amount of stored energy that can be removed from the battery at one time. For short time periods, however, the battery recovers and, except for the greater I^2R losses, delivers approximately the same total energy whether that energy is taken in short spurts at high current or as a continuous drain at a low current.

The specific weights of both hydraulic and pneumatic accumulators, or power-storage devices, are

shown in Figure 2. For both types there is a reduction in specific weight in the larger sizes. The specific weight of both types of accumulators includes the weight of the working-fluid pressure plus the weight of the compressed gas of the hydraulic accumulator. The method by which both air and oil are stored under pressure is well known and is not discussed here. The weight values used in plotting the chart in Figure 2 were supplied by manufacturers of aircraft accumulators and the values show a definite similarity. The pneumatic accumulators have lower specific weight, as can be expected, since all their volume is usable.

In comparing the relative specific weights of either a generating or storage medium as power sources for a given actuator, the data in Figure 2 are of interest to the aircraft-design engineer in a number of ways. The storage-battery line does not cross the generator line for any period of actuator discharge. For a load with a time duration of 20 sec, a storage battery weighs three times as much as a generator with equal capacity. For this reason, a storage battery is used to provide power only when the primary source of power is inoperative and to offer some voltage stabilization with fluctuating loads.

A hydraulic pump is also lighter than a hydraulic accumulator except for a demand of less than 2 sec. This indicates that the hydraulic accumulator is not used for the storage of energy but rather is used to absorb shock or surge in the system and to simplify the problem of unloading the hydraulic pump when the system demands are negligible.

When the pneumatic compressor with its high specific weight is compared with its air-storage-cylinder accumulator, the results are strikingly different. For any operation less than 4 min, it is lighter to store rather than to generate the energy. This is even more pertinent if the compressor is motor-driven, rather than engine-driven.

From Figure 2, the following conclusions can therefore, be drawn:

(a) Electric and hydraulic methods use energy storage only for extremely short-duration operation and for surge protection.

(b) The pneumatic method uses large storage capacity with the minimum possible size of compressor.

(c) Power for actuator operation when the prime source of power is shut down should be provided by a storage battery for long-term demands (over 20 sec) and by either a hydraulic or pneumatic accumulator for short-duration demands. For repetitive short-term demands, it is desirable to use an electrically driven pump to charge an accumulator rather than use either a large accumulator or a large storage battery with a high discharge rate.

POWER TRANSMISSION

The electric actuator system in aircraft uses a grounded return for d-c transmission and a 3-wire grounded neutral for 3-phase a-c transmission. Conductor size is determined by current density as well as voltage drop, and rigid specifications define the allowable limits for each. In military aircraft, conduit is seldom used. The computation of wire weight for any amount of power to be transmitted is very simple and follows conventional techniques. Aluminum is used for the larger sizes of cables to save weight. The use of high voltage, either alternating current or direct current, is imperative in large aircraft for everything but the smaller size actuators.

Aluminum tubing is used for both hydraulic and pneumatic transmission in those areas not subject to temperatures above 300° F. For higher temperatures, stainless-steel tubing may be used.

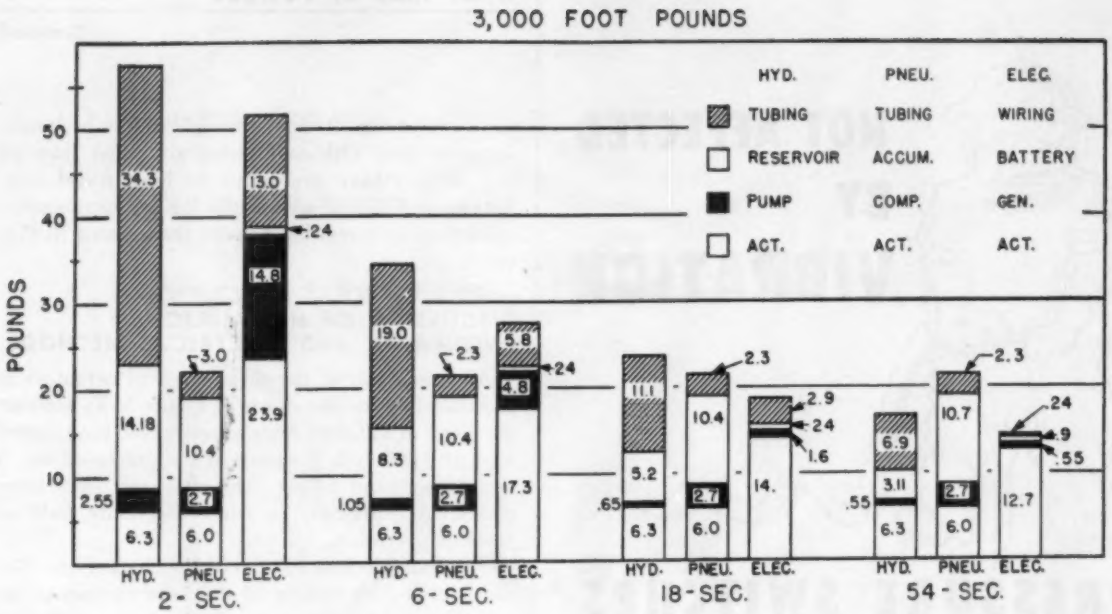
. . . most of the weight in a hydraulic system is in the transmission lines and fluid, reduce this factor and you can have the lightest system for all loads . . .

Figure 3 is a plot of the transmission-line weight necessary to transmit power 75 ft by the three media of actuator operation. The electric system uses a grounded return and a single power lead plus two control leads. It is based on a maximum voltage drop of 2 v on a 24-v system and on current ratings of the Army-Navy Specification AN-W-14a.

The hydraulic system makes use of both a pressure and a sump line. Tube size is chosen to permit a transmission efficiency of 90 per cent at –20° F. This is a rather severe basis for computation. An aircraft-design engineer may compromise somewhat on transmission efficiency to obtain a minimum overall system weight. The specific transmission weight of fluid at 3,000 psi is lower than at 1,500 psi for the same tubing stress and, thus, is used in this comparison.

The pneumatic system uses a single transmission line. This is made possible by exhausting directly into the atmosphere at the actuator. An operating pressure of 1,500 psi was chosen and the transmission efficiency was computed at 90 per cent. Temperature has a negligible effect.

The weight of both the hydraulic and pneumatic



5 WEIGHT COMPARISON for complete hydraulic, pneumatic and electrical systems, based on a load of 3000 ft-lbs and operating at various time durations. The greatest weight in the hydraulic method and the lowest in the pneumatic and electric methods is in the transmission of power. This chart is based on a 75 foot transmission distance. With a minimum length of transmission lines, the weight comparison changes.

transmision systems includes the weight of the working fluid.

POWER UTILIZATION

The means by which the power transmitted to the actuator is transferred into useful work by the actuator is dictated by the mechanical design of the structure to be moved. The output motion may be either linear or rotary, and the stroke-force relationship varies over wide limits. In the larger sizes, however, linear actuators fit into the structure more conveniently. In this article, linear actuators only are considered.

In the design of an electrical actuator, the motor, gear reduction, and screw are often coaxial and the complete assembly is installed much the same as a hydraulic cylinder. The motor is totally enclosed and is rated for short-time intermittent duty with the motor case forming part of the structure. Because of the high efficiency of the ball-bearing jack screw, even in the reverse direction, and the high efficiency of the gear-reduction assembly, the motor is provided with a magnetically released brake to prevent the unit from slipping under load. The motor diameter-to-length ratio is kept low to reduce starting time and to minimize the kinetic energy to be absorbed in the brake.

The size of the ball-bearing jack screw is dictated by the Brinelling capacity of the nut as well as by column strength of the screw. If the actuator is operating purely in tension, the screw can be smaller in diameter. The smaller sizes—usually under 1,500 ft-lb, where efficiency is an important factor—use a ball-bearing screw. For any one output rating, actuator weights may vary as much as three to one because of a variation in force-stroke combination and variation in operating time. There is, however, a distinct trend which the specific-weight curves drawn in Figure 4 illustrate. The electrical actuators vary from this trend if they have either a very short operating time, necessitating a large motor, or a long operating time, permitting a small motor with a higher gear ratio.

The overall efficiency of the larger size electrical actuator varies from 40 per cent to 70 per cent. For smaller sizes, these values are lower because overall efficiency is not important when compared to the weight reduction that can be realized by other means such as by simplified gear boxes.

The specific-weight curve for hydraulic actuators in Figure 4 represents a series of 20 hydraulic actuators of various sizes. These data show a smaller spread than in the case of the electrical actuators because the size of a hydraulic actuator is independent of its rate. The values given are for production units designed for a particular installation and for an operating pressure of 1,500 lb per sq in. Figure 4 shows the same relationship for pneumatic actua-

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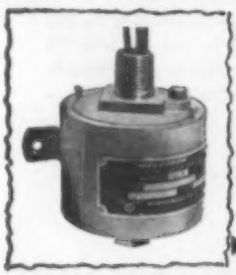

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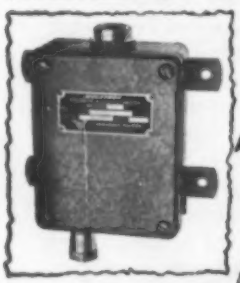

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tors. The pneumatic actuators are simply hydraulic actuators used with compressed air rather than oil and do not have provisions to limit travel rate. Actuators designed specifically for pneumatic operation may be somewhat heavier than shown in Figure 4.

DISCUSSION OF HYDRAULIC, PNEUMATIC, AND ELECTRICAL METHODS

A comparison of the three types of actuators is illustrated by the bar charts of Figure 5. To indicate the effect of different rates of operation, the selected load of 3,000 ft-lb is shown at four rates—2 sec, 6 sec, 18 sec, and 54 sec. The sizes and rates were picked hypothetically to cover the entire field of possible operation.

The code block at the top of the chart shows that the bottom-most section of the bars represents the actuator weight plus the weight of the operating medium. The specific weight of an electric actuator for an 18-sec operating cycle is obtained from Figure 4. The horsepower of this actuator then may be computed, assuming an overall efficiency of 50 per cent for the 3,000 ft-lb load.

The specific weights of the hydraulic and pneumatic actuators also are taken from Figure 4 and then, assuming an actuator efficiency of 95 per cent, the horsepower for each of the operating times may be computed.

The next division of the bars represents the weight of the generating source. For the electrical method, a generator size, arbitrarily chosen four times the demand of the actuator, has been selected and the generator specific weight taken from Figure 2. This is multiplied by the sum of the motor power plus line losses to give a value of generator weight chargeable to this actuator. If, in the event a four-times-actuator-power demand for the 2-sec actuator operation dictated a generator larger than is being built, the specific weight of the largest size being produced is used. The same specific generator weight has been used for each of the same size actuators when operating at a slower rate. It is assumed that 10 percent of the energy used by the actuator is provided by the battery; therefore, an allowance is made for this in plotting the generator weight.

To determine the weight of the generator source using the hydraulic method the weight of a pump to supply the actuator power, plus line losses, may be computed by using the specific weight of a pump with a power output four times the demand of the 2-sec actuator rate. To this may be added the weight of an accumulator capable of supplying 10 per cent of the energy. This same section of the pneumatic bar represents only the compressor and is not a direct comparison with the other two methods since the main source is carried in the storage section. The compressor must be the minimum size to recharge the storage in a 20-min period.

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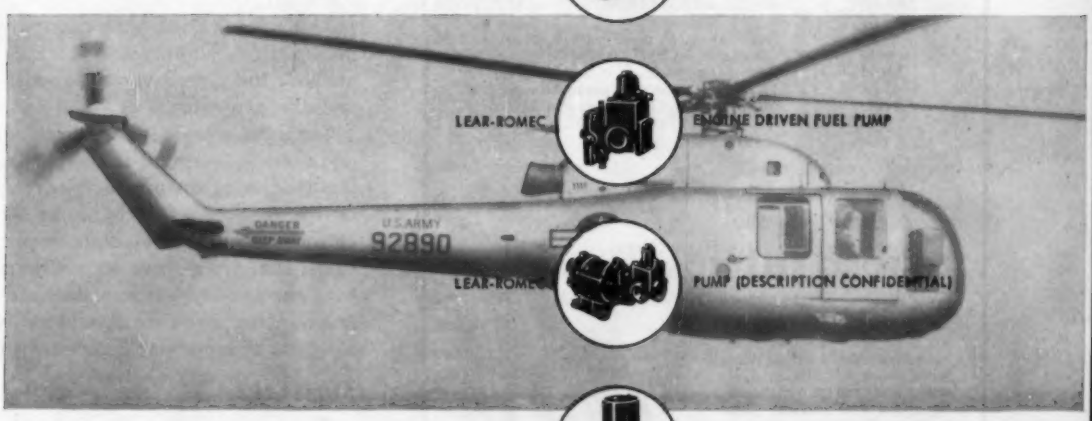

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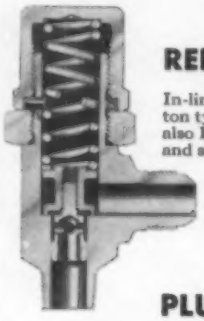

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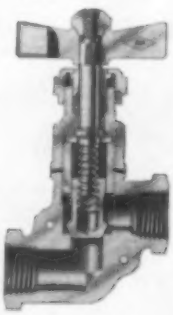

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WHAT KIND OF POWER?

Continued

The storage weight is represented by the third-from-bottom section of the bar. This section in the pneumatic bar represents the weight of the air bottles plus the air weight and was computed on the basis of two complete cycles of actuator operation (per Army-Navy Specification AN-P-86). In the hydraulic bars it represents the weight of the reservoir plus 120 per cent of the oil in the entire system. Storage in the electric method represents only the weight of 10 per cent of capacity in storage battery weight.

The top section of the bars represents the transmission weight for a 75-ft distance. The transmission weights for all of the systems were obtained from the chart shown in Figure 3.

An examination of Figure 5 shows that the pneumatic method is the lightest in the first two cases (2-sec and 6-sec time cycles) and the electric is the lightest in the longer time cycles. The pneumatic method is practically constant for all operating rates, whereas both the hydraulic and electric start out heavy and nearly equal and then taper down to be very close to the pneumatic weight at the 54-sec cycle. Hence, in the shortest time cycles the pneumatic method shows a very definite weight advantage, but in the longer time cycles any of the three methods could be used with the slight margin of advantage going to the electric method. It should be pointed out that the actuator weights for both the hydraulic and pneumatic methods are the same and constant for all operating rates. In fact, the pneumatic method is composed of constants, and the bar chart shows it is constant for all rates.

The larger variables in the hydraulic method are present in the tubing and storage. For the electric method, the larger variables exist in the actuator and the generator.

Since the greatest weight in the hydraulic method and the lowest weight in the pneumatic and electric methods are in the transmission of power, a line can be drawn through each of the bars in the chart, cutting off the transmission weight and its proportional share of storage weight. This line, then, indicates the weight of each method at a minimum transmission length. The hydraulic method is then shown to be the lightest for all rates.

SUMMARY

The trend can be summarized as follows: as the load is increased, the electric actuators can be used to more advantage. Also, with longer transmission distances and with decreasing operating rates, the electric actuators should be used.

With greater loads and at greater distances with faster operating rates, the pneumatic actuators are the preferred choice. With low and normal loads at minimum transmission length, the hydraulic actuators should be used for all rates. However, as the loads are increased, the electric method gains an advantage over the hydraulic at the lower operating rates. ▼▼▼

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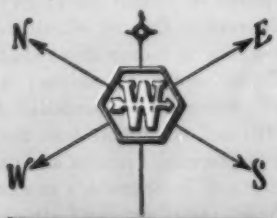

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Transport Aircraft Men Confer on Design and Operating Problems

THE fourth annual Transport Aircraft Hydraulic Conference, sponsored by Vickers, Inc., held at the Park Shelton Hotel, Detroit, November 3 and 4, was attended by nearly one hundred representatives of airline, airframe and suppliers of hydraulic equipment and materials for transport aircraft.

Marking a departure from previous conferences, two men divided the chairmanship—Fred T. Blum, hydraulic systems engineer, United Airlines and Robert F. Stapells, mechanical systems engineer, Canadair. Mr. Blum presided over sessions on variable and fixed displacement hydraulic pumps and motors, seals and accumulators; Mr. Stapells over sessions devoted to hydraulic fluids, valves, hose and general subjects.

A new feature of the Transport Conference was the time given to short, informal reports of new hydraulic systems and modifications to systems for transport aircraft. Three of the talks were on current types, the fourth on a new jet transport.

Design Changes on Convair 340

Dwight M. Moore, senior design engineer, Convair, in his paper "Modification of the Model 340 Main Hydraulic System to Improve Ground Cooling Operation", reported on several tests conducted by Convair in cooperation with service tests by four 340 operators. A decision was reached to use both a variable displacement and a fixed displacement pump in the main hydraulic system. Advantages claimed for the modification include: (1) unloader cycles reduced more than 99 percent; (2) less fatigue on hose and tube pressure lines; (3) reduction of pressure peaks in return lines; (4) use of separate reservoir return line to eliminate transmission of shock waves to motor drive shaft seals; (5) damping of fan motor pulsations; and (6) reduction of fan motor noise transmission into the structure. An additional advantage was the utilization of both fixed displacement pumps and unloaders in planes in service and in operator's stocks.

William W. Thayer, assistant chief air conditioning engineer, Douglas Aircraft Co., in "Hydraulic Aspects of the Douglas Cabin Supercharger Drive (DC-6 through DC-7)", reviewed the various drives

Continued on page 68

USEFUL LITERATURE

HYDRAULIC CYLINDERS . . . Available in eight different mounting styles and ten bore sizes from 2 to 8 inches, Lindberg Engineering Company describes in Bulletin 701 hydraulic cylinders for service up to 3000 psi. The cylinders have rotating caps, welded flange construction eliminates need for tie rods, the packing made of special asbestos cloth and rubber compound resists high temperature, neoprene O-rings and socket cap screws. This 28-page bulletin carries detailed drawings, and chart-tables show bore sizes and pressures.

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HYDRAULIC PUMPS . . . Eastern Industries Inc. feature in Buletin 800 their hydraulic pump and fluid motor line. Complete engineering data on the working pressures, capacities, drive speeds, efficiency and weight are given for each series and photographs of the pump are shown. Also included are installation and ordering data and one page is devoted to basic hydraulic circuits.

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ELECTRIC TIMERS . . . A bulletin on electric timers has been published by Eagle Signal Corporation. These timers can start and stop motors, operate valves or any electrical control device which must operate with a delay or in a timed sequence. They provide automatic control to cut production costs and to improve the quality of a product. Covered are manual start timers, repeat cycle timers, aircraft and special timers and control panels. Product description, specifications, wiring diagrams and applications are all fully illustrated.

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PROTECTIVE SLEEVES . . . Protection for every need is described in Bulletin AH-2 issued by A & A Manufacturing Company. Sleeves and boots, molded of a neoprene-base material in a wide range of stock-ring sizes are available. Tables give maximum and minimum lengths and a wide range of ID x OD sleeve sizes. Telescopic sleeves for special purposes are also available.

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OIL COOLERS . . . The Heat-X-Changer Co., Inc., prepared an 8-page brochure outlining the type OCX inner-fin oil coolers. Constructed with seamless oil tubes, the oil passage contains the compact and highly efficient copper inner-fins. The oil side is suitable for pressures up to 250 psi and temperatures up to 300 F. Applications for this type oil-cooler include hydraulic presses, turbines, compressors, hydraulic couplings, torque converters and many others. Dimensions, construction data, rating charts and miscellaneous technical data are given.

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LIMIT SWITCHES . . . A new 24 page, two color, Catalog No. 82 of precision snap-action switches has been published by Micro Switch. This catalog covers safety, limit and interlock switches designed especially for switching ac circuits in industrial and commercial applications. Complete information is included on heavy duty precision limit switches, switches enclosed in metal housings, some of which are sealed against the splash of oil and water. Application ideas are also shown.

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Model ES4-KM2
½ actual size

ELIMINATES INTERLOCKING SWITCHES AND COMPLICATED ACTUATING DOGS

Ideal for pulsing solenoid valves on air-hydraulic controls, sequencing circuits, etc., because it allows other controls to reverse or operate the same circuit. Switch sends a short electrical impulse and then switches itself out of the circuit.

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Switch replaces timers, relays, and troublesome one-way dogs to simplify circuits — cuts chances for failure. No delicate adjustments.

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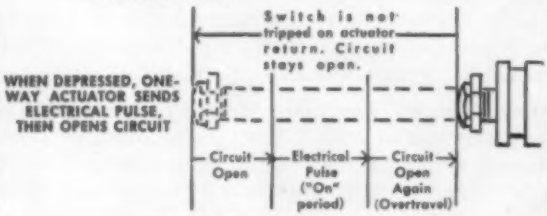
Impulse switch costs less than complicated control devices it replaces. Fewer switches are required for sequencing. Simple mounting.

SPEEDS UP AUTOMATIC OPERATION

Automatic machines can run faster because cycles can be more closely sequenced. There's no delay due to timer tolerances or extra machine motions to actuate interlock switches.


Switch is not tripped on actuator return. Circuit stays open.
WHEN DEPRESSED, ONE-WAY ACTUATOR SENDS ELECTRICAL PULSE, THEN OPENS CIRCUIT
Circuit Open
Electrical Pulse ("On" period)
Circuit Open Again (Overtravel)

SPECIFICATIONS

UL rated at 10 amps/125v AC Movement Dif. .020"
Operating Force 3½ lbs.

Model No.	Overtravel	"On" Period (inches of actuator travel)
ES4-KM1	3/8"	1/16"
ES4-KM2	5/16"	1/8"
ES4-KM3	1/4"	3/16"
ES4-KM6	1/16"	3/8"

TRY ON YOUR CONTROL JOB — ORDER NOW
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Specify Model Wanted—Discounts on Quantity Purchases

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ELECTRO-SNAP SWITCH & MFG. COMPANY
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TRANSPORT AIRCRAFT CONFERENCE

Continued

for several models of Douglas cabin superchargers, including the DC-7 models of transport aircraft. He described development and service problems incident to new models of the cabin supercharger for improved aircraft models. He presented data to show how overhaul time has been consistently reduced through design changes and discussed in detail a new modification being installed in the supercharger to eliminate air from the hydraulic system to improve the operating characteristics of the drive.

Two papers on the second day of the Conference presented recent developments for the Constellation main hydraulic system and the hydraulic system on the new Boeing 707 Transport, the first American jet transport.

Meeting chairmen
Robert F. Stapells, Canadair, Fred T. Blum, United Airlines, chat with Walter Flinn of Vickers, Inc.

E. W. Kesselman, hydraulics design group engineer, Lockheed Aircraft Corporation, dealt primarily with hydraulic system changes to speed up landing gear retraction on the Super Constellation in his paper "Recent Developments for the Constellation Hydraulic System". He also touched on three other developments in the past year—a new simplified hydraulic cross over system, the installation of the Vickers lightweight pump (not yet flight tested) and a new emergency extension and brake system. The main change in the latter is the addition of an electric motor driven pump to backstop the hand pump as an emergency power source.

E. Pfafman's presentation of the highlights on the hydraulic system of the first American jet transport, the Boeing 707 and showing of a movie of the first flight tests, was one of the outstanding features of the Conference. Mr. Pfafman, assistant project engineer-systems, Boeing Airplane Co., outlined the procedure followed in designing the hydraulic system in his paper, "Design of the Hydraulic System of the Boeing 707 Transport". In contrast to the de Haviland Comet I's complex five separate hydraulic systems, the 707 has only two hydraulic sys-

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tems. The system was designed in reverse, in that studies were first made to determine what should not be done. Hydraulic problems on current airplanes were discussed thoroughly with personnel at maintenance bases. The two hydraulic systems supply power for the brake system, landing gear operations, nose gear steering, flap and wing spoiler operation.

As in other Transport Conferences, the major part of the time was devoted to discussions on an agenda which had been prepared from questions submitted by airline operators.

SEALS

Canadair reported that Teflon back-up rings were found damaged after a short period in service. Apparently the sharp corners of the free ends of the ring had cut into the central portion of the material. These were associated with standard "O" rings. Two builders suggested solid rings and reported successful use. The suggestion made at a recent A-6 meeting was also brought out—that the edges be rounded out.

Douglas, El Segundo, reported that the new Delta "O" rings gave better spiralling resistance but that they wore faster. The Air Force, after experimenting with Delta rings in outrigger landing gear struts, has returned to the round "O" ring. While solid rings could be used in such places as nose retract and nose steering cylinders, Teflon rings are difficult to install over end caps or in glands, since the rings must be tight for good service life.

HYDRAULIC FLUIDS

It is apparent that the airlines are moving slowly on synthetic types of fire-resistant hydraulic fluids. Skydrol, developed by Monsanto with the close cooperation of Douglas, is in the clear lead with their ester-based compounds now in service in over 500 transports operated by over 30 airlines. A low temperature version, Skydrol 500 (–65 to 225 F) is growing in popularity in England. Another Monsanto fluid, OS45, developed for high temperature operation is in limited use in military aircraft. Most operators agreed that high temperature fluids will not be necessary on new transports. Hollingshead H2, still in use on some operational Navy planes, is being replaced systematically. A Carbide and Carbon Chemical Co. representative outlined the work being done on Hydrolube 18, the newest water base fluid being developed by this company.

HYDRAULIC HOSE

Aeroquip reported two new high temperature hoses under development. They expect to be ready for either type of fluid for transports. Weatherhead is working on three types of aircraft hose—one, soon expected to be ready for service testing is for 4000 psi operating pressures with 125 percent overload and anticipated life of 100,000 cycles.

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Cyl. Dia. Bore	STOCK STROKE LENGTHS — All Double Acting								
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1½"	24.16	25.72	26.08	26.44	27.16	27.88	28.60	29.32	30.40
2"	26.24	27.88	28.32	28.76	29.64	30.52	31.40	32.28	33.60
2½"	32.36	34.12	34.68	35.24	36.36	37.48	38.60	39.72	41.40
3"	35.04	37.28	37.92	38.56	39.84	41.12	42.40	43.68	45.60
4"	40.84	43.68	44.52	45.36	47.04	48.72	50.40	52.08	54.60
4½"	48.96	51.92	52.88	53.84	55.76	57.68	59.60	61.52	64.40
6"	66.60	70.80	72.20	73.60	76.40	79.20	82.00	84.80	89.00
8"	.....	126.80	129.20	131.60	136.40	141.20	146.00	150.80	158.00

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Engineering Corporation
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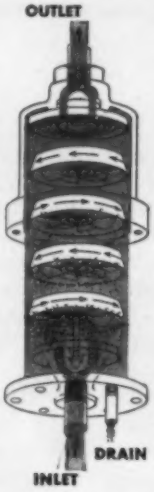
SCRUBS, CLEANS AND DRIES
On Air and Gas Lines



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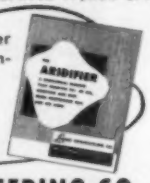

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will it help YOU?

Instant Free Flow

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Operation of the Hydra-Seal Coupler is as simple as inserting or removing a plug from an electrical outlet. To couple, hook on and push together; to uncouple, pull apart; no tools are needed. As the barrels are hooked over the slide lugs and the coupler pushed together, the barrels displace the slides and the barrel ports are brought into register or alignment . . . thus allowing the free flow of fluid through the coupler. Pulling the coupler apart brings the slides into position over the ports—oil is sealed in, dirt sealed out.

Let Char-Lynn solve your coupler problems.

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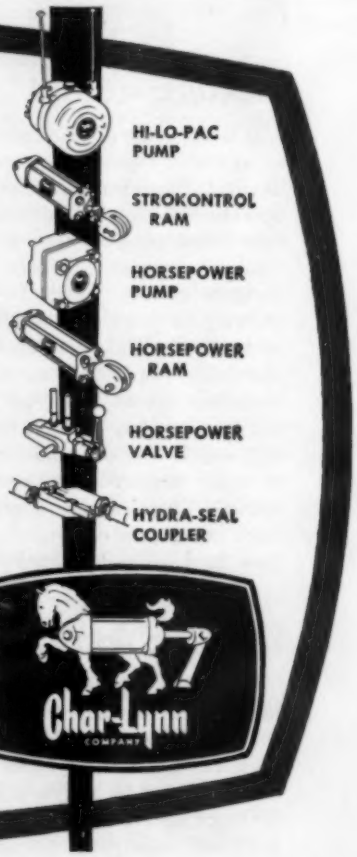
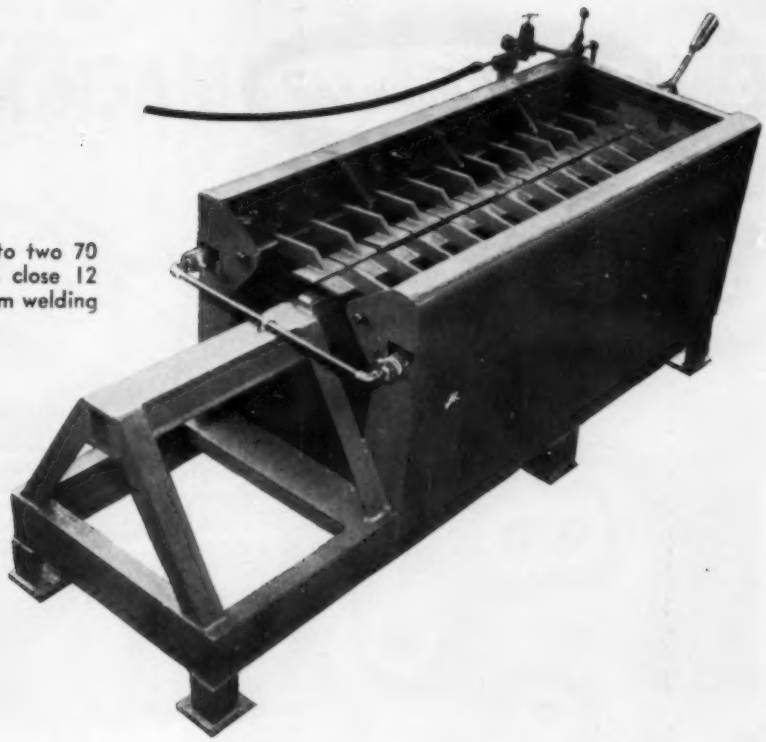




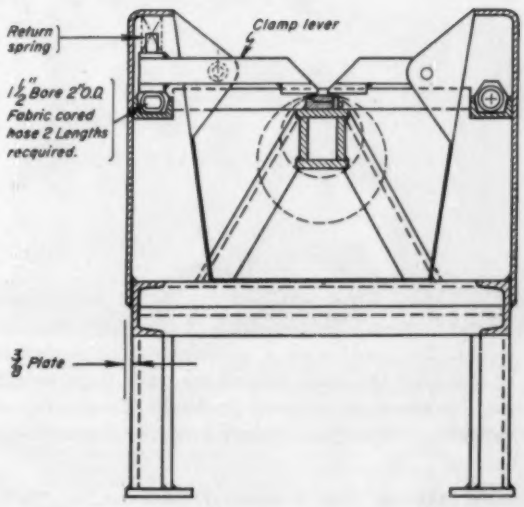
Air pressure is applied to two 70 inch lengths of hose to close 12 pairs of clamps on a seam welding fixture.

AIR HOSE ACTUATES CLAMPS

TO clamp a long shell on a seam welding fixture, engineers at Standard Machine & Tool Co. Ltd. came up with an inexpensive power device which gives fast simultaneous clamping action and takes very little space. The device is a length of 1½ inch ID fabric cord hose.

A pad on one end of each clamp lever contacts the work; a pad on the other end rests on the rubber hose. A manually operated air valve controls the flow of compressed air in and out of the hose which acts as an equalizing air cylinder to operate the clamping levers. When the air is exhausted from the hose, springs on the end of each lever compress the hose and unclamp the work.

A welded box section beam, fastened at one end to the frame, supports the work and resists the clamping pressure. The open end of the beam is supported, while under clamping pressure, by a hand operated latch, which is swung out of the way while loading and unloading. ▼▼▼



NEW *Fluid Powered* MACHINES

CRANE MECHANISM takes up only 18 inches of truck bed length.

COMPACT TRUCK CRANE DESIGN

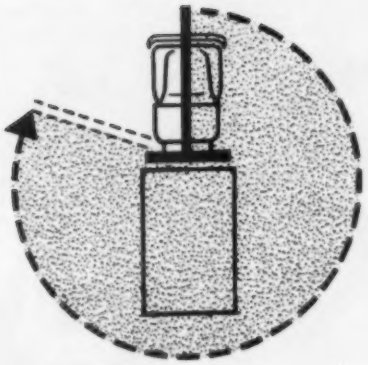
gives greater profits with increased payload

• By Cliff Raymond and W.R. Ranney

WOULD a truck mounted crane that could load and unload its own truck be useful? Sure it would. But could such a combination be designed so that after the crane was on the truck there would still be room for a good payload? To develop a versatile, compact and simple unit, the engineers at Truck-Crane, Inc. selected hydraulic power to perform all the crane operations. On their 5000 pound capacity crane, hydraulics is used to swing the boom, extend the boom, drive the winch, adjust the guy lines, operate the stabilizers and, when needed, to power work grab attachments.

This hydraulic package and winch is built into a frame which takes up only 18 inches of truck length. The history of this design dates back to 1936

CLIFF RAYMOND, *Chief Engineer, Truck-Crane, Inc.*, W. R. RANNEY, *Norris, Hydraulic Control Co., Chicago, Ill.*



Boom swing is powered by a rotary actuator which eliminates heavy friction loads of a cable and pulley mechanism. The torque actuator provides 280 degrees of rotation.

when a crane to load timbers on trucks was needed. This first truck mounted crane used a friction clutch driven winch. There was no powered boom swing or extension. In 1947, renewed interest in this equipment led to the addition of a hydraulic system to extend the boom, power the swing and stabilize the truck. The boom swing was done with a cylinder operated cable and pulley arrangement. The 6 inch diameter cylinder pulled ¾ inch cable around 5 inch diameter sheaves. Much of the power was used just to overcome the heavy friction loads at the pulleys. This system was cumbersome and the friction clutch drive on the winch had serious stop-start-reverse control disadvantages. To overcome the shortcomings of a mechanically driven winch and cable powered swing, the all-hydraulic truck-crane was developed.

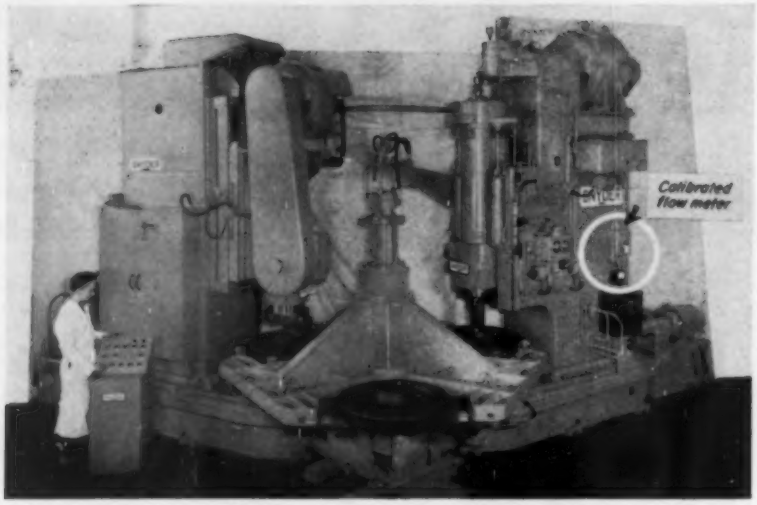
GEAR MOTOR DRIVES WINCH

Boom swing is now powered by a 280 degree, single vane, rotary actuator which is compact and completely eliminates pulleys and cables for the swing. The winch drive is now powered with a precision built, highly efficient gear type fluid motor. Control from a 4-way valve is simple, safe and positive. Speed control in both directions is simply obtained by throttling the oil through the directional control valve. The winch is locked when the control valve is in neutral. And, because of the check valve which is built into the control valve, there is no possibility of accidental load drop when the control valve is reversed.

Power for all hydraulic operations is supplied by a gear pump driven from a power take-off on the truck engine. The pump delivers 25 gpm when operating at a speed of 1200 rpm. Maximum pressure setting is 1000 psi. Control of all operations is from a 5 plunger ¾ inch valve bank with control handles on both sides. Automatic hydraulic locking of each operation is accomplished by releasing the valve lever.

▼▼▼

ALL MOTIONS OF THE CRANE are controlled from a 5 plunger bank of 4-way three position control valves. For convenience there is a bank valve on both sides of the truck. The hydraulic controls eliminate brakes and clutches.



Do you always know the feed rate on your machine?
If rate control is a problem, you'll want to know about this machine circuit.

CALIBRATED FLOW METER

Accurately Indicates Boring Feeds

● By H. Cutler

IT is important on many machine tools to know at all times the exact cutting feed in inches per minute. The only way to have an exact reading during operation is to install an accurately calibrated flow meter.

When a tool is fed hydraulically, adjustment of flow control valves or adjustment of pump delivery permits stepless control of the feed rate. However, for any given flow control valve setting the operator does not generally have an immediate indication of feed in inches per minute. He may establish the feed on the basis of surface finish on the cut workpiece. This requires time for cut-and-try which can be troublesome. Also, after locking a flow control valve at the desired flow rate, speed variations due to viscosity changes may still occur.

On the boring machine pictured in Figure 1, the builders, Snyder Tool & Engineering Company, installed two calibrated variable area flow meters. This machine is used to face and bore the hub of forged steel railroad car wheels. Machine cycle time is 1½ minutes for one wheel which has a 6¾ inch bore, 7 inch long after facing. One of

H. CUTLER, *Design Engineer, Snyder Tool & Engineering Co., Detroit, Mich.*

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FIG. 1. FLOW METERS are used in the facing and boring tool feed circuits on this railroad wheel boring machine.

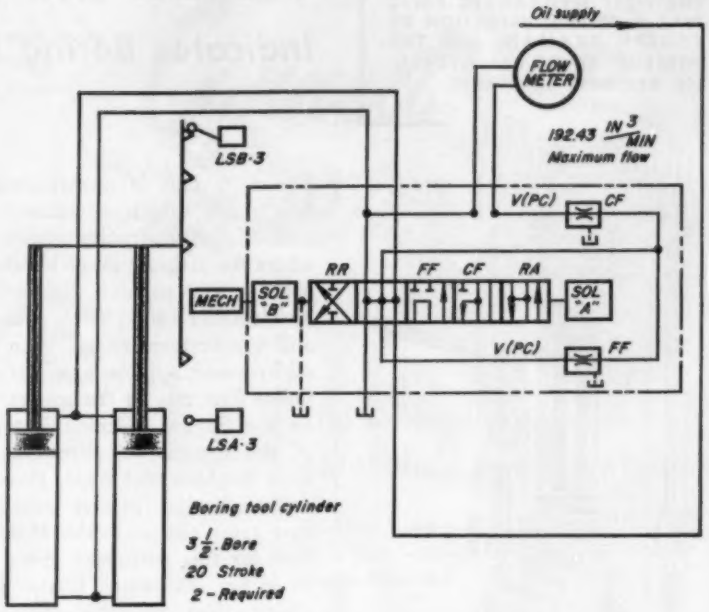

FIG. 2. FEED CIRCUIT for the boring tools on the machine shown in Figure 1. The flow meter is in series with the flow control valves which are connected in a meter-out circuit.

the flow meters is in the facing circuit and the second is connected in the boring feed circuit as shown in Figure 2.

The entire machine cycle is electrically actuated from load to unload. In the boring circuit a special five position control valve directs oil flow to obtain rapid advance, coarse feed, fine feed, rapid return and stop. Feed control is regulated by a standard meter-out circuit having two pressure compensated flow control valves. One adjusts fine feed, the other coarse feed. The calibrated flow meter is in series with the flow control valves. The flow meter will handle a maximum flow of 192.43 cu in per minute. This is equivalent to a speed of 10 inches per minute at the boring tools. Any adjustment of the flow control valve or any variation of flow due to viscosity results in a reading at the flow meter in inches per minute at the cutting tool. All guess work about feed rates is removed by use of the meter.

Selecting a flow meter for machine tool applications such as the wheel boring machine requires information on desired flow, pressure and operating temperature. The type of meter used on this particular installation is shown schematically in

Continued on page 76

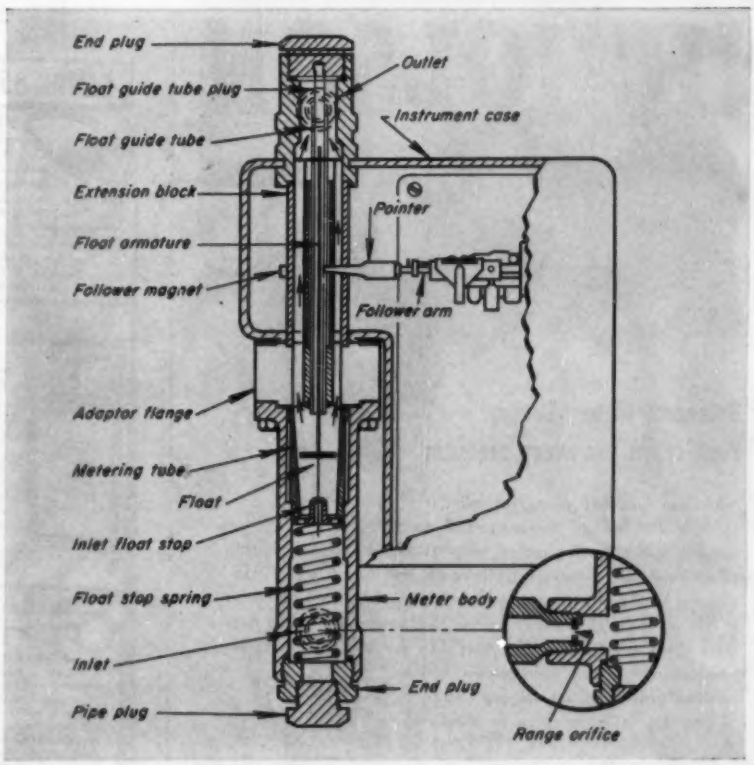

FIG. 3. CROSS-SECTION of the variable area flow meter which is calibrated to read directly in inches per minute of cutting feed at the tools.

Courtesy Fischer & Porter Company

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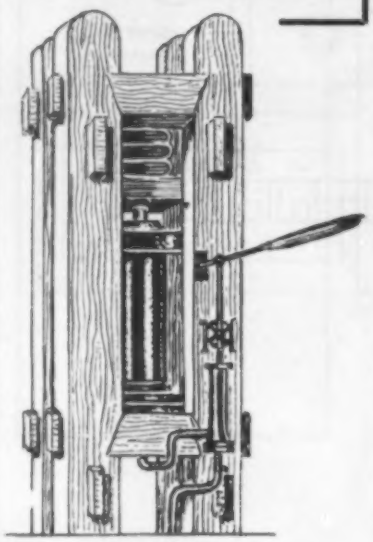

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Calibrated Flow Meter Indicates Boring Feeds

Concluded from page 75

Figure 3. This is a variable area flow meter which is suitable for industrial oil hydraulic applications where the pressure range is between 600 to 2000 psi and the temperature is under 140 F. These pressures and temperature ranges cover most oil hydraulic applications. The maximum flow rate of the meters used on the Snyder machine is typical of the capacity requirements for most machine tool feeds. However, meters having greater maximum flow rates are available. Minimum flow for this particular meter is 7 cu in per min which is also about the practical minimum provided by oil hydraulic flow control valves.

Here's how the meter works. Referring to Figure 3, the flow comes in at the bottom passes through the metering tube, past the metering float and on out the top. An extension on the metering float has a magnet imbedded in it. The follower arm with an attached follower magnet is outside the stainless steel float extension well and positions itself opposite the magnet imbedded in the float extension. The pointer indicates, on the calibrated scale, the flow rate.

As can be seen from the drawing of the meter, flow measurement is a measure of the position of the float in the metering tube for a given flow rate. This arrangement makes flow proportional to the area and their relationship is linear. Flow ranges of 10 to 1 or greater can be handled.

Flow measurement requirements on hydraulically fed machine tools can readily be met by calibrated meters. Their use results in simpler adjustment and control of speeds.

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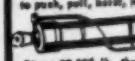

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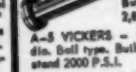
SIZE: 68" high, 27" wide, 29" base

HYDRAULIC HAND PUMP

Operating pressure 1500 PSI. Cap., 1.5 cu. in per complete cycle ... 12.75



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Useful Literature continued

SELF-SEALING HYDRAULIC COUPLERS . . . for use on any hydraulic system regardless of high pressure, are illustrated in a 4-page bulletin. These couplers, manufactured by Pioneer Hydraulics, Inc., are of the "Quick" and "Break-Away" types, feature swivel action. Couplers maintain full free flow of fluid with minimum turbulence; the ball checks are held exactly in the center of the line of the coupled position. Sizes and applications for each type coupler are given and their prices listed.

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HYDRAULIC CRANKING MOTOR . . . known as the Hydrotor, provides a higher and hitherto unobtainable stored starting capacity in a unit of comparable size. The unit operates in a closed hydraulic system completely independent from batteries and does not require regular maintenance checks. The essential features of the Hydrotor which is made in three sizes are illustrated and described in a folder published by Hydramotive, Inc.

Fill in No. 119 on Reader Service Card

SILICONE PRODUCTS REFERENCE GUIDE . . . published by Dow Corning Corporation will help give engineers a maximum amount of information on silicones in limited space. The 1955 guide lists some 23 new products besides the 100 odd mentioned in previous issues. Still retained is the "division by application" method of listing individual products, helping engineers to locate a product by what it does rather than what it is. The application index has been increased from 17 to 21 classifications. The guide contains many tables, graphs and photos.

Fill in No. 120 on Reader Service Card

PILOT TYPE RELIEF VALVES . . . are detailed in new catalog sheets available from Fluid Controls, Inc. Designed to limit pressure in a system or part of a system, these valves are compact in design, light in weight and silent in operation. The catalog sheets illustrate use, operation and features of the valves, show cross sectional drawings of the design, a typical installation diagram and include a table showing operating performance.

Fill in No. 121 on Reader Service Card

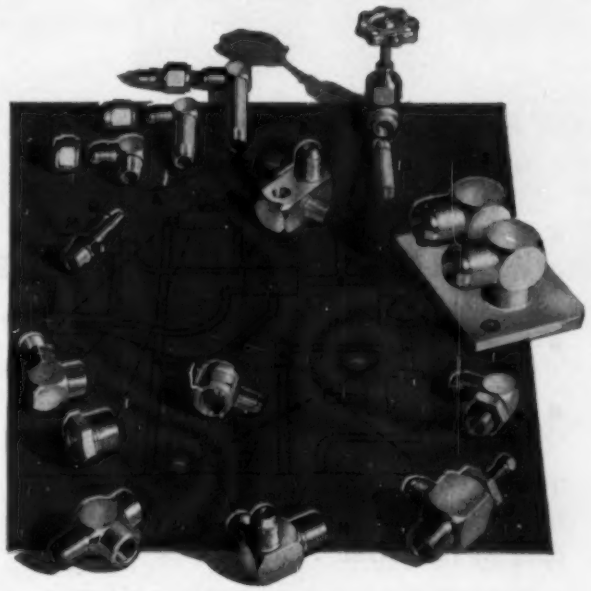
"ORIGINAL EQUIPMENT APPLICATION IDEAS FOR PRODUCT DESIGNERS" . . . is the title of a new brochure by Gast Manufacturing Corp. Bulletin 1054-5 shows how 35 product component problems were solved with rotary air motors, air compressors and vacuum pumps manufactured by the company. Photographs of applications, together with detailed captions

Continued on next page

Connect up with L and L

The Complete Line of Steel Fluid Power Couplings

JIC Flare Tube — Pipe Threaded
Flare Tube — Straight Thread "O" Ring
Flange Mounted — "O" Ring Seal



A—JIC Flare Tube Fittings	G—Ball Check Valve
B—Manifold Fitting	H—Lateral Outlet Fitting
C—Needle Valve	I—Universal Elbow
D—Pipe Nipple	J—Dryseal Pipe Fitting
E—Flange Manifold	K—Hex Reducing Bushing
F—Straight Thread, "O" Ring Seal Fitting	L—Swivel Elbow
	M—Barbed Hose Stem

You can depend on L & L's quality, availability, and selection of steel couplings for piping all industrial hydraulic circuits.

Distributors in principal cities
Write for catalog No. 53

L and L MANUFACTURING COMPANY
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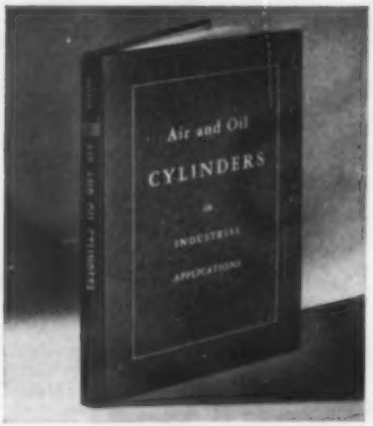
If YOU Design, Select, Or Maintain CYLINDERS Or Equipment Which Includes Cylinders, MANY PROBLEMS You Encounter May Be Explained, Simplified, Or Avoided



FOR EXAMPLE—DO YOU KNOW

- ***HOW*** to protect piston rods? to appraise cushion action?
- ***WHEN*** to use larger diameter piston rods?
- ***WHERE*** a short cushion proves advantageous?
- ***WHY*** air systems should be exhausted befor servicing cylinders?
- ***WHAT*** allowance to make for cylinder friction?

These are typical problems discussed in the new book "Air and Oil Cylinders in Industrial Applications"

First book of its kind—based on 18 years of first hand experience in working with plant equipment people on cylinder design, selection and application. It is easy to read and understand.

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Address .....

Useful Literature continued

describing hp requirements, air pressure used, rpm of the unit and other data, are shown. Names of companies using these products are given under each application. Briefly described are also recent additions to the Gast line of original equipment components.

Fill in No. 122 on Reader Service Card

RE-USABLE COUPLINGS . . . for medium-high and high pressure service, which feature a double-wedge grip, are described in Bulletin H-100 offered by Joy Manufacturing Company. The double wedge grip permits assembly on rubber covered hose without skiving. Through use of a special slotted bushing it is possible to retighten the coupling on the hose without disassembly when and if it comes loose through vibration or flexing. No special tools are required for assembling couplings on hose.

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"CUSTOMIZED RUBBER ENGINEERING" . . . is the title of a folder which shows what happens when you bring hydraulic sealing problems to Plastic and Rubber Products Company. Folder features in cartoon style how the company is able to design and custom produce a part with fine finish and close dimensional

Continued on page 80

★ Heavy grey iron casting, accurately machined surfaces.

★ Power factor—15 times air line pressure of 5 to 150 lbs.

★ Throat clearance to center of 18" diam. circle.

★ Ram clearance 0 to 5", stroke 5/8", table 5" x 5".

This useful, high quality No. 80 SPEEDY AIR PRESS is the last word in air power engineering—the result of 34 years of specialization in diaphragm compression. Extremely sturdy, it does dozens of jobs formerly handled by expensive presses—and does them more quickly, easily and economically. Operated by Speedy Foot Control, Hand, or Fingertip Valves. Order from your supplier or write direct.

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Making "Sling Shots" safer for our air fields afloat

It takes tremendous power to launch a plane from a carrier deck—more, in fact, than the plane itself can develop. And this extra power is supplied by the ships catapults—powerful hydraulic mechanisms that literally "throw" the planes into the air at flying speed.

This machinery is below deck, in the hold of the ship where every precaution against fire must be taken. That means that the hydraulic fluid in these powerful "sling shots" must be "safe from the fire hazard standpoint". In addition, the fluid must be non-toxic, stable and provide the lubricity necessary to protect moving parts.

The hydraulic fluid chosen to meet these requirements—and now installed in U.S. Navy carriers—is Houghto-Safe, Houghton's new development in non-flammable hydraulic fluids for industry. Be sure your hydraulic equipment—and your plant—have this same protection against hydraulic oil fires. Ask your Houghton Man or write for Houghto-Safe Bulletin. E. F. Houghton & Co., 303 W. Lehigh Avenue, Philadelphia 33, Pa.

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Ready to give you on-the-job service . . .

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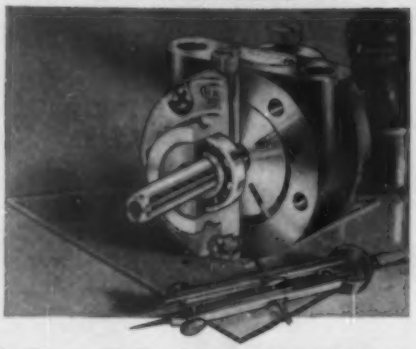
Rotary Air Motors
1/20 to 4 h.p.



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to 30 p.s.i.
to 24 c.f.m.

Vacuum Pumps
to 28 in.
to 24 c.f.m.

Always striving for simplicity in your products? So are we. Simplicity lowers costs — increases dependability. And it's a *big* reason why engineers and users favor Gast components.

A rotor and four sliding vanes are the only moving parts. Centrifugal force holds self-seating vanes tightly against the interior of housing, maintaining a continuous seal, and taking up any wear automatically. Air delivery is positive, pulseless, quiet . . . without bulky air tank.

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- COMPRESSORS TO 30 P.S.I.
- VACUUM PUMPS TO 28 IN.

See Our Catalog in Sweet's Product Design File

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against dirt, moisture, loss of fluids

PROTECT IT!
against thread damage

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C-3

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Western District Office • Times Building, Long Beach, California

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Useful Literature continued

tolerances. Their engineering, testing, mixing and molding facilities enable the company to tailor make rubber requirements for hydraulic, pneumatic, aircraft, automotive, machine tool and many other applications.

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FLEXIBLE COUPLINGS . . . of the rubber-bronze bushing type are the subject of a selection guide prepared by Ajax Flexible Coupling Co., Inc. This selection guide, Bulletin 57, gives complete ratings, drawings, specifications, service factors and various uses of the types illustrated. This pocket size brochure also shows that the flexible rubber bushings provide necessary freedom of movement between each flange, and a cushioned drive in both directions of rotation.

Fill in No. 125 on Reader Service Card

FLUID POWER DEVICES . . . including cylinders, valves and packaged units are briefly described and illustrated in a 4-page bulletin published by Modernair Corporation. All the units featured in this literature are fully described in individual brochures available upon request. Highlights of the company's facilities are included. One page pictures and describes typical applications of components made by Modernair.

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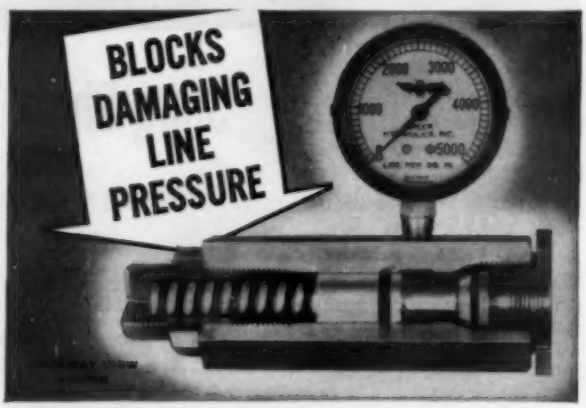

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Available in pressure ranges from 10 psi to 5,000 psi. Interchangeable springs convert valve from one pressure range to another easily. Greer Cutout Valves pay for themselves quickly. For low-cost protection, call Greer today.

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O-RING . . . for aircraft hydraulic service, with a temperature range of minus 65 degrees to plus 400 degrees Fahrenheit has been developed by Parker Appliance Company. This new rubber material meets Military specifications MIL-P-5516A and MIL-P-18017. A spec sheet is available.

Fill in No. 127 on Reader Service Card

OVER-RUNNING CLUTCH AND COUPLING . . . their construction and operating characteristics are outlined in Bulletin No. 231, offered by The Hilliard Corporation. Various types of clutches are featured together with sectional drawings and complete technical specifications.

Fill in No. 128 on Reader Service Card

AIR MOTORS AND VALVES . . . manufactured by The Bellows Company are featured in a 28-page bulletin, SP-50. This "Spec-Book" illustrates and describes completely dimensions and specifications of their air motors and valves. 75 illustrations and 27 specification charts help facilitate the application of these units. Charts give size and capacity designations. Accessory items are also included in the bulletin.

Fill in No. 129 on Reader Service Card

INDUSTRIAL RUBBER PRODUCTS . . . made by Quaker Rubber Corporation, Division of H. K. Porter Company, Inc., are illustrated in a new 58-page general catalog. The catalog is divided into sections for quick reference to a product. There are sections on packings, hose, belting and molded rubber products. Each product described is illustrated in a cut-away section. Performance data, specifications, working pressures, weights and all technical information is given. There is also complete information on different types of hose couplings.

Fill in No. 130 on Reader Service Card

CONTROL INSTRUMENTS . . . United States Gauge, Division of American Machine and Metals, Inc., published a 4-page Bulletin, GL-1, featuring the Gotham line of indicating, recording and controlling instruments. The bulletin also covers portable running time-temperature recorders, pneumatic off-on indicating controllers and pneumatic proportional recorders for 1 to 100 per cent proportional band.

Fill in No. 131 on Reader Service Card

AIR-GRIP CLUTCH . . . for press operation is outlined in a 4-page folder available from Dodge Manufacturing Corp. Embodying several new features, this clutch operates at air pressures up to 150 psi. A cross section drawing shows internal construction. Information is given on air control, release valves, clutch sizes, bore sizes and weights.

Fill in No. 132 on Reader Service Card

ELECTRIC MOTORS . . . which conform to the new NEMA Standards for mounting dimensions and frame assignments for integral horsepower motors are shown in bulletin No. 1600 published by The Louis Allis Co. Comparison of principal dimension between old and new frames are charted for the 1—40 hp induction motors.

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CENTURY'S All-new Oil Level Sight Gage

No Easier Installation Ever Designed

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6. Prompt delivery of cylinders or parts from factory or dealer stocks in principal cities.

Why gamble when you can get PROVENAIR—the pioneer corrosion-resistant cylinder backed by more than 10 years successful use? Write today for new MODERNAIR catalog—most complete in industry!

5

Modernair CORPORATION
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New Products continued

PRESSURE SWITCH
. . . weighs 4 ounces-handles 5-12,000 psi

Features: Unit is housed in aluminum castings, all metal parts processed to resist corrosion. It's built to withstand tremendous surge pressures. Extremely close tolerance on actuation. Unit is easily adaptable to any installation and operative in any medium.

Leach Relay Co.
Division of Leach Corp.
Los Angeles, Calif.

Fill in No. 150 on Reader Service Card

PIPE CONNECTOR
. . . has swivel nut on one end

Designation: SFG

Design: Male end of this connector has Dryseal pipe threads, swivel nut of the unit has straight threads to screw onto the male fitting which is specially chamfered to provide a metal-to-metal seating to assure leak-proof connection.

Features: It permits installation in those instances where otherwise direct mounting of the male pipe thread hose fitting would result in twisting of the hose.

Applications: For re-usable Hozlok fittings for hydraulic hose.

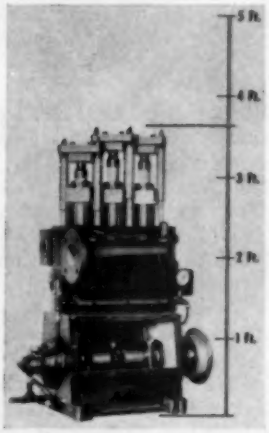
The Parker Appliance Company
Cleveland, Ohio

Fill in No. 151 on Reader Service Card

SMALL TRIPLEX PUMP
. . . helps lower costs

Designation: Powr-Pac

Construction: Pump is precision machined throughout, crankshaft is die-forged of high grade carbon steel. The frame is a semi-steel casting with power-end moving parts totally enclosed. Plungers are made of heat-treated carbon steel, stainless steel, porcelain or bronze.

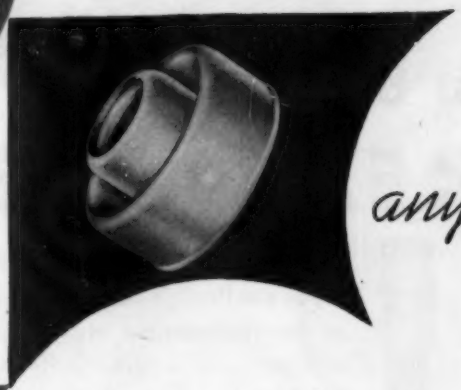


Features: This unit embraces the direct flow fluid-end principle. Individual fluid-end sections are easily replaced.

Specifications: This 2½ inch stroke 25 hp unit is available in plunger diameters from 2½ inch to 11/32 inch, for pressures from 390

Continued on page 84

any size...



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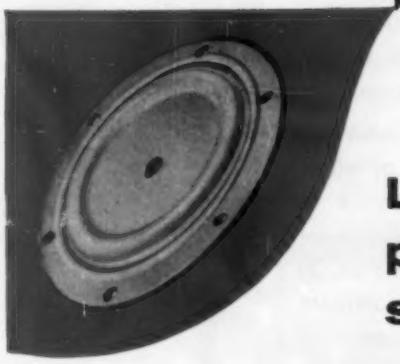

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The combination of micrometer accuracy and superior physicals in LINEAR Precision Molded Silicones results from constant research and testing. It extends into virtually every field of industry. Where dimensional stability or long shelf life is a must, it pays to specify LINEAR.

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In the development of new uses for flexible hose, Flex-O-Tube provides you with dependable experience in the field. When used for replacement in industrial maintenance, Flex-O-Tube provides you with a complete range of products that are easy to assemble and long on performance.

Whatever your needs, why not discuss them with the local Flex-O-Tube field engineer. You'll find there are many good reasons why industry has relied on Flex-O-Tube for miles and miles of flexible hose products.

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Flex-O-Tube Co. (Canada) Ltd., Windsor, Ontario

New Products / continued

psi to 20,700 psi, with displacement from 109.6 gpm to 2.08 gpm.

Applications: For use in many operations, including die casting, press operations and hydraulic testing.

The Aldrich Pump Company
Philadelphia, Pa.

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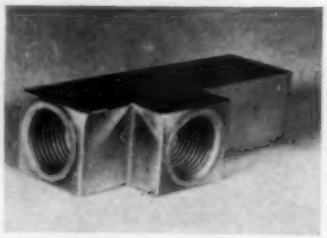
AIR BLEED VALVE
. . . for hydraulic systems

Features: For use in all types of hydraulic systems, this automatic, self bleeding valve bleeds air out of a hydraulic system while the system is in operation. Installation of this valve eliminates necessity of manual bleeding operations and reduces maintenance on the equipment. Self bleeding valves are connected ad-



jacent to the entrance ports of the hydraulic cylinders.

Specifications: Valves are made for all standard sizes lines and for all pressure ranges.

Applications: For use on machine tools, earth moving equipment, automotive, aircraft and industrial brakes, and other applications utilizing hydraulic power.

Radial Metal Products, Inc.
Brooklyn, New York

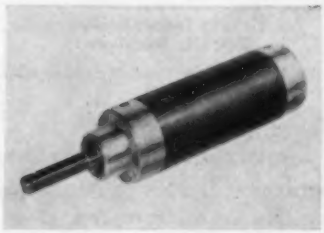
Fill in No. 153 on Reader Service Card

POWER CYLINDER
. . . for air and oil use

Designation: Power Drive

Design: Cylinder has extra-strong stainless steel ground and polished piston, to give the rod seal, bearing, and wiper longer life. The rod wiper and self-lubricating bronze bearing protect the finish on piston rod and

assure maximum strength. The gland, consisting of the wiper, oilite bearing and self-compensating packing, can be replaced without dismantling the cylinder.



Features: Lightweight construction, sealed-in lubrication; large ports and unrestricted passages permit maximum speeds. The cylinder can be used with interchangeable mountings.

Applications: It can be operated on 500 psi maximum oil or water service, or 200 psi on air, without interchanging or adding parts.

Sizes: Bore diameters available are 1½, 2¼, 3 and 4 inches.

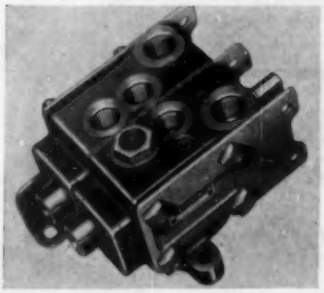
National Pneumatics Co. Inc.
Industrial Actuators and Controls Div.
Boston, Mass.

Fill in No. 154 on Reader Service Card

MULTIPLE UNIT VALVE
. . . for mobile machines

Designation: Series CM 11

Design: Valve is made up of standardized and interchangeable units assembled in combinations, up to 8 sections, between special compact combination inlet and outlet units. The inlet section is a single casting that combines inlet manifold, operating valve and relief valve; outlet unit, also a one-piece casting, combines outlet manifold, operating



valve and end plate. Combined form makes the valve physically smaller than would be possible using all separate sections. O-ring seals provide leakproof joints between the

Continued on next page

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INFORMATION

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Any application calling for a positive, permanent static seal against pressures, internal or vacuum. Various platings for protection of the seal against jet engine fuels, lubricating and hydraulic oils, combustion gases, liquid metals, special fuels.

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New Products continued

mating faces of valve sections. Hydraulically balanced valve plungers construction in the unit prevents plungers from kicking out of position due to excessive back pressure or surges.

Features: This valve design features a 3-point mounting for ease of installation. It can be adapted for tandem operation, where two or more valve banks are installed in series, to split the unit around some structural member.

Specifications: This series is available in double-acting and single-acting operating valves in addition to the combination inlet and outlet units. Maximum working pressure is 2000 psi, pressure drop through the valve is 50 psi.

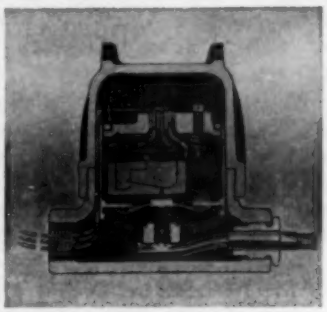
Applications: For use on material handling equipment, road and construction machinery, farm implements and trucks.

Vickers Incorporated
Detroit, Michigan

Fill in No. 155 on Reader Service Card

PRESSURE SWITCHES
. . . in explosion-proof housing

Features: Units are unusually compact, they are accurate, repeat within plus or minus 1 percent of setting. This new line of pressure switches covers the range of 30 inch-



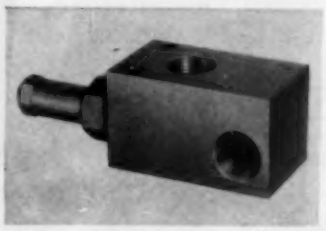
es of mercury proof vacuum to 150 psi pressure. Standard models are available for single or dual settings. Units are automatically reset by the snap action characteristics of the switches.

Barksdale Valves
Los Angeles, California

Fill in No. 156 on Reader Service Card

RELIEF VALVE
. . . features new design

Features: This oil valve is of the spring loaded, guided piston type. In operation, the pressure force on the piston is equal to the spring force against it. As pressure increases, the



spring is compressed and the piston uncovers the outlet ports. Fluid in the spring cavity dampens the valve and prevents chatter. Both piston and its sleeve are of hardened steel.

No more skiving Hydraulic Hose!
use JOY
SURGEPRUF
. . . THE NON-SKIVE COUPLING
WITH THE DOUBLE-WEDGE GRIP
PERMITS THE USE OF MORE ABRASION-RESISTANT, RUBBER-COVERED HOSE
Insure longer wear in your hydraulic hose assemblies—and at the same time, save assembly time by avoiding old-fashioned skiving. Joy Surgepruf re-usable couplings make both advantages possible. Their exclusive "double-wedge" grip lets you use tough, abrasion-resistant, rubber-covered hose instead of the braided type—without any need for skiving the hose at the connection.
NO SPECIAL ASSEMBLY TOOLS REQUIRED
You need no mandrels or other special tools to make up Surgepruf assemblies. No extra expense or special technique is involved.
CAN BE RETIGHTENED WHEN LOOSE ON THE HOSE
Machine vibration or hose flexing can loosen any hydraulic coupling on the hose in time, but Surgepruf Couplings can be easily, quickly retightened on the job to stop a leak—another exclusive feature.
Surgepruf Hose Couplings are made to JIC Standards. Assemblies are available in many sizes and lengths, and in both single and double-wire reinforced types for medium-high and high pressure service respectively. Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.
Consult a Joy Engineer
JOY
HYDRAULIC ASSEMBLIES THAT GIVE YOU MAXIMUM RELIABILITY
WAD H5506

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Fill in No. 47 →

HEAVY DUTY

Hydraulic Cylinders

- **All steel construction—no tie rods, no castings.**
- **Hard chromed and ground piston rod to resist abrasion and prolong seal life.**
- **Self adjusting seals.**
- **Five standard mountings.**
- **Ample rod guide.**
- **Rod wiper seals fitted as standard.**
- **Cushioning at either end or both ends of stroke.**
- **Stroke length to suit your application.**
- **Standard range 2" to 6" bore, double acting.**
- **For working pressures up to 1,500 p.s.i.**
- **Double ended rods available for all standard cylinders.**
- **Special mountings, larger bores and cylinders for higher pressures by arrangement.**

Keelavite *hydraulics*

PUMP/MOTOR UNITS, VALVES, POWER PACKS, TRANSMISSIONS & REMOTE CONTROL SYSTEMS

The recognised Authority on Hydraulic Power Transmission

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Telephone : Meriden 225/6 Telegrams : Keelavite, Coventry

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AH/01

New Products continued

Sizes: Available in cartridge style for oil at 10 to 600 psi, with a hand knob pressure adjustment, and in ⅜, ½ and ¾ inch pipe sizes.

Applications: To control pressure in clamping and feed circuits.

Fluid Controls, Inc.
Mentor, Ohio

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ELECTRIC MOTOR
. . . produces faster, accurate response

Designation: Super "T" Line

Design: To withstand the rigors of hard usage the heavy shaft is keyed to the armature, and the commutator, which is firmly supported by both shaft and armature spider form the mechanical structure for the windings. The new bearing mount has been improved by the addition of a metering plate which increases protection against overlubrication. Brush rigging is so arranged as to be readily accessible for inspection and maintenance.

Features: Rugged construction enable motor to take full load and overloads, change speed rapidly, maintain torque and tension, reverse and stop quickly. The time required to accelerate to full speed has been cut to half the time previously required.

Specifications: Available in sizes from 20—100 hp for D.C. operation. A complete range of mechanical enclosures are available to assure protection under any operating conditions.

Reliance Electric and Engineering Co.
Cleveland, Ohio

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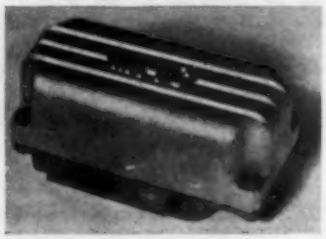
AIR VALVE
. . . is completely enclosed

Designation: Model #541

Features: This ¼ inch 4-way solenoid-operated, spring-return valve is



light-weight and compact. Rugged aluminum cover protects both the solenoid and valve against dust, dirt and water. The cover is gasket sealed with locked-in screws for added convenience.

Mechanical Air Controls, Inc.
Detroit, Michigan

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Continued on page 90

A New Gresen Product

DIFFERENTIAL RELIEF VALVE
Of Greater Capacity

Model D75

The Quality Valve At Mass Production Prices.

Features

★ Grey Cast Iron Body
★ Hardened Steel Plunger and Seat
★ Smooth Operating Pressure Regulating Screw
★ Light Spring Has Long Life and Low Stress

Pressure Range: 50 to 1250 P.S.I.
Capacity: 24 G.P.M. @ 15 ft/sec

Relief valve of smaller capacity available in our Model DR75.

Write for Literature

GRESEN MANUFACTURING CO.
628 Colfax Ave. N. Dept. H-93 Minneapolis 11, Minn.

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CLAMP YOUR WORK *HYDRAULICALLY!*

This folder shows how to *SLASH ASSEMBLY TIMES*

POWER JACKS LIMITED
VALETTA RD. · ACTON · LONDON · W.3

1060

Simple • Inexpensive
Instantaneous
for
MILLING • GRINDING
WELDING • GLUEING
and every Clamping Problem

A NEWTON PRODUCT

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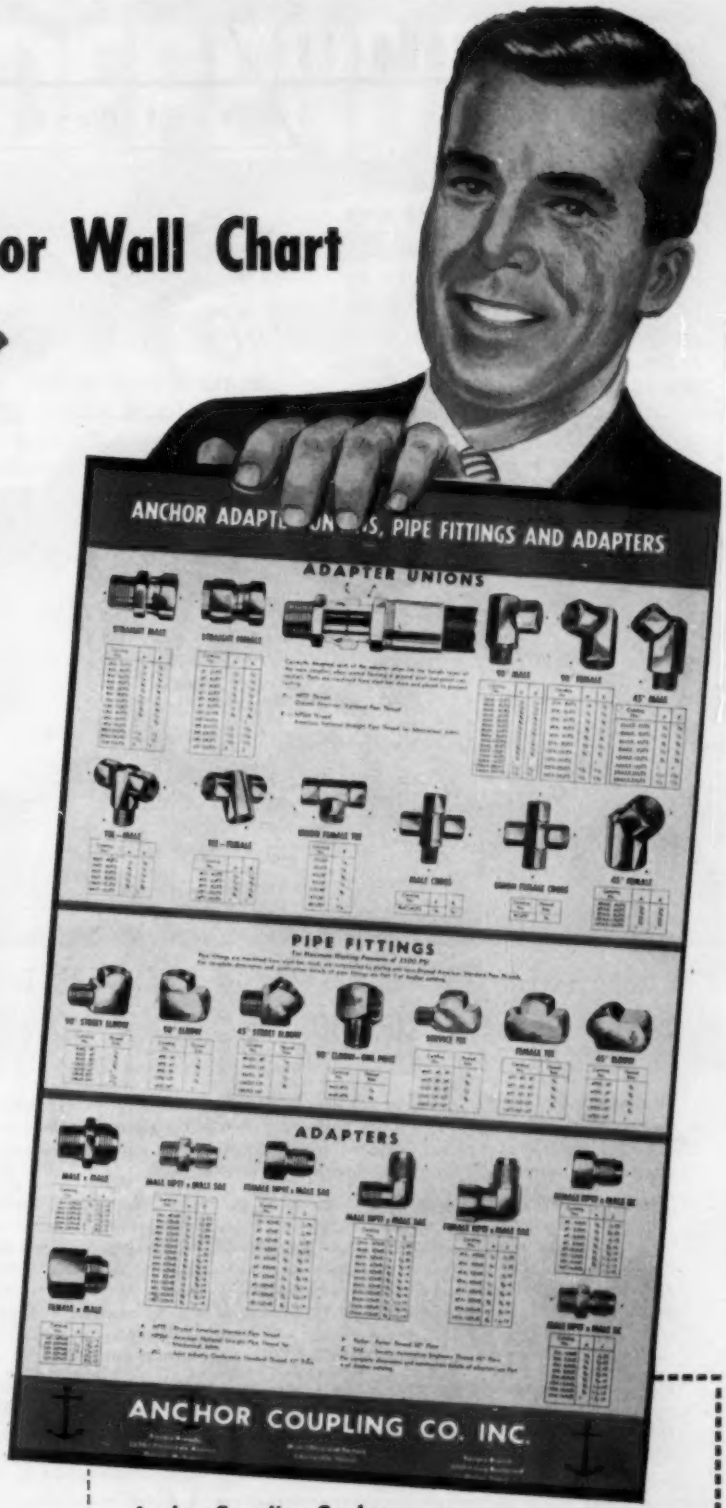
Send for this time-saving Anchor Wall Chart *Today!*



Get concise, useful information fast on Anchor adapter unions, pipe fittings, and adapters

HERE'S an attractive, easy-to-read, 17" x 28" wall chart that gives you handy information in a hurry. It carries a complete listing of all commonly used Anchor adapter unions, pipe fittings, and adapters.

You get a quick summary of types available, catalog numbers, sizes, and thread data — everything you need to design, specify, or order — at a glance. Chances are you won't need to look any further, because the Anchor line is the largest and most complete available anywhere—and the chart shows every unit you ordinarily need.

Naturally there's no charge or obligation for this useful chart. Simply mail the coupon now and we'll see that this handy Anchor Wall Chart reaches you promptly.

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Factory Branches:
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Plymouth, Michigan
(In the Greater Detroit Area)
2100 Irving Boulevard
Dallas, Texas

Anchor Coupling Co. Inc.
Department AH-25, Libertyville, Illinois

I'd like an Anchor Wall Chart. Send me one, pronto.

Name..... Title.....

Company.....

Address.....

City..... (.....) State.....

D-22

New Products / continued

HEAVY DUTY CYLINDER
. . . has hydraulic depth stop

Designation: Strokontrol Ram

Features: Thumb-screw collar on piston rod can be set at any desired position to stop the retracting stroke at the given point until collar position is changed.

Construction: Cylinder utilizes high strength aluminum alloy castings, hard chrome plated piston rod, blocked V seals.

Specifications: This double-acting cylinder has a 3½ inch bore, available in stroke length up to 16 inches. Designed for operating pressures up to 1200 psi.

Char-Lynn Company
Minneapolis, Minnesota

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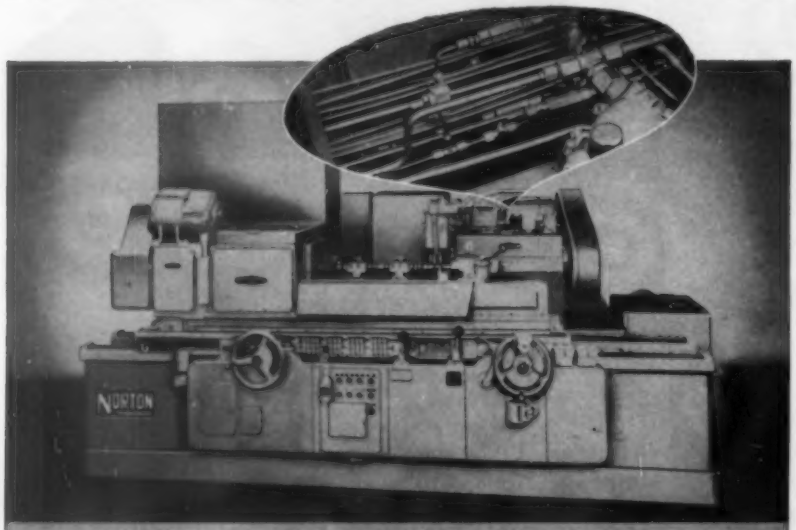


CAMSHAFT GRINDING—HIGH PRESSURE JOB TAILOR MADE FOR SUPERIOR HYDRAULIC TUBING

One reason why Detroit can turn out cars in such huge numbers is their use of new machine tools which, until a few years ago, were just a gleam in a designer's eye. Good example is the Cam-O-Matic* . . . a high speed, fully automatic camshaft grinder developed by the Norton Company of Worcester, Mass.

The Cam-O-Matic has a highly complex hydraulic system for holding and positioning work, controlled by an electronic brain which times the sequences of operation. To make this tubing network as failure-free as possible, Norton engineers selected Superior carbon steel hydraulic tubing as a standard component. They knew from experience that Superior *higher-than-industry-quality* tubing can take (1) the punishment of vibration; (2) the high pressures put out by modern hydraulic circulating systems; (3) the severe flaring and bending necessary in assembly. As a result, machine down-time due to tubing failure has been eliminated.

If you use hydraulic tubing and your specifications demand exact analysis, unusual fabricating ease and dimensions that are precise—specify Superior. Mail this coupon today for Bulletin 38, Catalog Section 30 and the name of your nearest distributor.

*Trade Mark Reg. U.S. Pat. Off.

Superior
THE BIG NAME IN SMALL TUBING
All analyses .010" to ⅝" O.D.
Certain analyses (.035" max. wall) up to 1⅛" O.D.

Superior Tube Company
2030 Germantown Ave., Norristown, Pa.

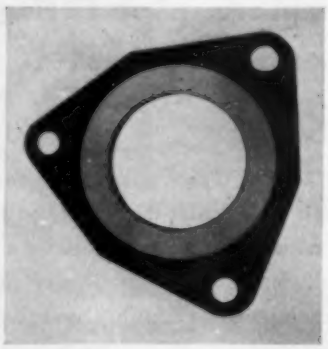
Please send Bulletin 38, Catalog Section 30 on Superior hydraulic tubing, and the name of my nearest Superior distributor.

Name_____
Company_____
Address_____
City_____ Zone____ State____

GASKET
. . . eliminates line turbulence

Designation: Free Flow

Design: Inner periphery of this Teflon gasket is of channel construction, so that it does not extend beyond the inside diameter of the pipe to cause a throttling action. It also assures full contact with the pipe flanges. This design permits the insert to extend to the full depth of the gasket envelope, thereby eliminating an air space.



Specifications: Available in all shapes and sizes for a wide variety of applications.

Crane Packing Co.
Chicago, Illinois

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MICRONIC FILTER
. . . for high pressure systems

Designation: Models 1700-1701 series

Features: Two types of filter elements are available, one filters to 40 microns, the other to 10 microns. Both are interchangeable in the same housing. Built-in relief valve prevents crushing of element due to dirt accumulation resulting from lack of maintenance. Filter elements can be easily and quickly replaced

without breaking pressure connections. It can be mounted in any position to facilitate installation and servicing.

Specifications: Operating pressure up to 3000 psi; relief valve opens at 75-80 psi. Unit weighs 2 pounds.

Waterman Engineering Co.
Evanston, Illinois

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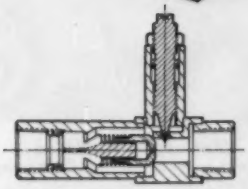
DEPENDABLE

RESTRICTOR VALVES

- **CAN'T STICK OPEN** due to dirt in oil
- **HOLDS ADJUSTMENT** will not leak
- **STRONG** burst pressure over 10,000 P. S. I.
- ¼", ⅜", ½" and ¾" pipe sizes
- For oil at pressures to 3,000 P. S. I.

Write or phone Mentor, Ohio, Blackburn 5-2625 for complete specifications.



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Manufacturers of Hydraulic Valves and Devices
Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators

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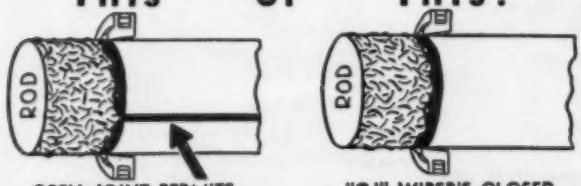
Member Of The National Fluid Power Association

For Industrial Use—

This or This?



OPEN JOINT PERMITS A STREAK OF DIRT AT JOINT OPENING

"CJ" WIPER'S CLOSED JOINT KEEPS THE ENTIRE ROD CLEAN

For these dry operations requiring absolute freedom from dust or dirt passing through joint of ring to bearings or packings, we have especially designed—the

FALL WIPER RING with Closed Joint

(our P/N-FWR-CJ)

In addition to the above, and since 1944, we have also manufactured **For Army and Navy Use the 3 Piece FALL WIPER RING FWR-3C**

Spec. Mil-S-8049, AN Approved, Military part numbers from AN6231A1, ½", to AN6231A71, 13", diameter. This ring consists of 3 pieces assembled into one . . (1) a one-piece Split Wiper Ring (Body) with 2 flanges or groove in its O.D.; (2) a one-piece split compressor spring assembled in groove (3) and endless cover band surrounding spring in groove which causes squeeze grip action on piston rod.

Squeeze Grip Action Does It—patented

—and squeeze grip is always the same because uniform tension of spring under endless cover band. Rods or pistons do not stick or become immobile in ANY temperature.

Our engineers will gladly work with you on any wiper ring problem. Write, wire or phone us.

Ace Products Co., Toledo 1, Ohio

Fall Wiper Ring SPRING LOADED

Phone Adams 6813

Covered by patents issued and patents pending.

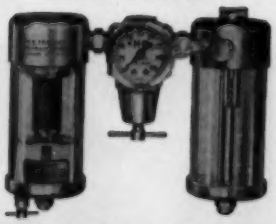
M·B

WHIRL-A-WAY

FILTER-REGULATOR and LUBRICATOR ASSEMBLY

MODEL W-3

the BEST PROTECTION TO YOUR AIR-VALVES, CYLINDERS, PNEUMATIC TOOLS, ETC.



WRITE FOR LITERATURE

The FILTER removes solids .00039 and larger. TRANSPARENT BOWL provides visibility. REGULATOR capable of passing large volume with unrestricted flow and minimum pressure drop. LUBRICATOR delivers desired volume of oil. Bowl can be refilled without shutting off air supply.

ANY OF THESE 3 DEVICES CAN BE USED AS SEPARATE UNITS OR IN ANY COMBINATION

M·B PRODUCTS
46 VICTOR AVE., Div. 10
DETROIT 3, MICHIGAN

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Post Scripts of Industry

News about people, manufacturers and sales organizations

Charles H. Wilkinson
Logansport Machine Company

Charles H. Wilkinson was appointed president of **Logansport Machine Company.** Wilkinson assumed his new duties with a broad background and experience after several years of service in various departments of the plant.

Edward J. Scott
Greer Hydraulics of Canada Ltd.

Greer Hydraulics, Inc. has announced the formation of a Canadian subsidiary, **Greer Hydraulics of Canada, Ltd.** A wholly owned subsidiary, the new firm was established in order to provide the Canadian government, aircraft manufacturers and airlines with the complete facilities for the repair, maintenance and modification of test equipment. The company has set up its plant and offices in Montreal. **Edward J. Scott,** who for the last four years has been assistant sales manager, was appointed operational manager of the new firm.

William J. Hipp
The Denison Engineering Co.

Snap-Tite, Incorporated, appointed **Norman Engineering Company,** Chicago, as representative for the Chicago and outside Chicago area. John A. Warren is president of Norman Engineering. The **Rucker Company,** Oakland, California was appointed Snap-Tite's Western distributor. Rucker will cover the states of California, Arizona, Nevada, Oregon, Washington and Idaho.

The Denison Engineering Company named **William J. Hipp** as field engineer in the Cleveland area. Hipp has been associated with the hydraulic field for several years in various capacities.

The Hydreco Division of the New York Air Brake Co., named **Ray J. Thomas** manager of its sales order department.

A. Brown was appointed controller of the **Adel Precision Products Division** of General Metals Corporation, Burbank, California. Brown was previously controller of the Solar Aircraft Company's San Diego Plant.

Jack Wyatt was named district manager of the Detroit, Michigan, area for the **Electro Dynamic Division** of General Dynamics Corp.

Berry Division of Oliver Iron and Steel Corporation opened new sales and engineering offices in Chicago. **W. L. Denniston,** formerly in the company's Pittsburgh home office, will serve as Chicago district sales engineer.

Pacific Tube Company, Los Angeles, California, broke ground for a major expansion of their stainless steel tube pickling facilities. The company hopes to have the new facilities in operation by mid-February.

New York Belting & Packing Co., named **Woodbury & Co.,** Portland, to be distributor for their products in the state of Oregon.

Continued on page 94

Fill in No. 83 ⟶

Fiatt, Illinois Mine uses STANOIL *Industrial Oil in stripper hydraulic jacks for 18 years*

At Truax-Traer Coal Company's Fiatt, Illinois, mine, the production goal is 1,000 tons of coal an hour. That's a stiff assignment. It leaves no margin for failure. This indeed applies to the hydraulic jacks of the company's Bucyrus-Erie 950-B stripper. It's the reason STANOIL Industrial Oil has been used as the hydraulic fluid in the four hydraulic jacks since the stripper went into operation in 1937. Eighteen years continuous service is testimony to STANOIL'S ability to deliver under any operating condition—heat, cold, rain, dust, dirt.

But there's more to the story than just the ability of STANOIL Industrial Oil to deliver under a wide range of operating conditions. The rest of the story is the Standard technical service provided by men with training and experience.

This combination — (1) top quality products (2) technical service provided by experienced men — is ready to serve you. Want this combination to go to work for you? In the midwest just call your nearby Standard Oil lubrication specialist. Or contact: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Since start of operations in 1937, STANOIL Industrial Oil has been used as hydraulic fluid in Bucyrus-Erie stripper at Truax-Traer Coal Company mine, Fiatt, Illinois. This 950-B stripper is hub of one of the biggest strip mining operations in Fulton County, state's second largest coal producing county.

Bob Wright, Standard Oil lubrication specialist is on the spot to provide technical service on lubrication problems. Bob has a B.S. in engineering from Michigan College of Mining. Before entering field sales work, Bob completed Standard's Sales Engineering School course in industrial lubrication. Customers find this experience and background pay off for them.

STANDARD

STANDARD OIL COMPANY

(Indiana)

Post Scripts of Industry
continued

The board of directors of **Robertshaw-Fulton Controls (Canada) Limited,** recently formed subsidiary of Robertshaw-Fulton Controls Company, elected **John A. Robertshaw,** president, **George A. Elliott,** vice president and general manager, **Walter H. Steffler,** secretary and treasurer, **B. D. Taylor,** comptroller, and **H. William Biggar,** assistant secretary and assistant treasurer. Elliott is in charge of the company's Toronto manufacturing plant.

The New York Air Brake Company has opened an office in Washington, D.C. **Harry A. Carragher,** formerly staff sales engineer in the Stratopower sales section, was appointed office manager.

E. Burke Neff was elected vice president and general manager of **Minnesota Silicone Rubber, Inc.** Neff was formerly the manager of the company, a position he held for four years.

E. Burke Neff
Minnesota Silicone Rubber, Inc.

Westinghouse Air Brake Company appointed **Charles J. Haring** as director of equipment sales. Haring, who joined the company's executive staff, has been general sales manager of J. D. Adams Manufacturing Co.

Ralph A. Rockwell was named chief engineer for **Minneapolis-Honeywell Regulator Company's** valve division. Formerly technical consultant to the division, Rockwell will continue to serve as advisor to the division's sales and engineering departments.

Lear, Incorporated, appointed **Arthur H. Fogelman** as a sales engineer to augment the staff at the company's new offices in Washington, D.C.

Bendix Aviation Corporation appointed **A. P. Fontaine** as director of engineering and **Dr. A. C. Hall** as general manager of the research laboratories. Fontaine, who

Continued on page 96

Quality without compromise . . .

CYLINDERS

- The JLE "Work Horse" Cylinder line for air pressures to 250 psi, designed for our own exacting applications on wire machinery, is rugged and dependable. Available in four standard mountings, both cushioned and non-cushioned, in bore sizes 1½ to 10 in.
- The new JLE Square Cylinders for air and low pressure hydraulic service, are available in interchangeable stock mountings, fixed, automatic or adjustable cushions in bore sizes from 1½ to 16 inches.
- Engineering service available for all fluid power problems. Contact your nearest authorized distributor listed below.

TERRITORIAL REPRESENTATIVE

ROESSEL & COMPANY
683 Hudson Avenue, Rochester 17, N. Y.
H. B. PARKE CO.,
401 Butler St., Pittsburgh 23, Pa.
JOHN HENRY FOSTER CO.
2510 University Ave., S. E. Minneapolis 14, Minn.
CONTINENTAL AIR EQUIPMENT CO.
4112 Fourth Ave., Brooklyn 32, New York
AIR-OIL EQUIPMENT COMPANY
3422 West 60th St., Cleveland 2,O.
JOHN HENRY FOSTER CO.
2850 Gravois Ave., St. Louis 18, Mo.
JARRETT COMPRESSOR & EQUIPMENT, INC.
275 Central Avenue, Newark 4, New Jersey
HOFMAN ENGINEERING CO.
5601 South Crawford Ave., Chicago 29, Illinois
BURKLYN COMPANY
3429 Glendale Blvd., Los Angeles 39, California
CHARLES A. KONSTANCE CO.
3921 N. Broad St., Philadelphia 40, Pa.
LAUER & LITTLETON
8799 Lyndon Ave., Detroit, Michigan
HUSH-SHEPHERD CO.
Rimmon Road, Seymour, Connecticut

Send for new JLE Cylinder Catalog HP 102

JAMES L. ENTWISTLE CO.
1475 Elmwood Ave. • Cranston (Prov. 7), R.I.

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"MONOBALL"
Self-Aligning Bearings

CHARACTERISTICS

	ANALYSIS	RECOMMENDED USE
1	Stainless Steel Ball and Race	For types operating under high temperature (800-1200 degrees F.).
2	Chrome Moly Steel Ball and Race	For types operating under high radial ultimate loads (3000-893,000 lbs.).
3	Bronze Race and Chrome Moly Steel Ball	For types operating under normal loads with minimum friction requirements.

Thousands in use. Backed by years of service life. Wide variety of Plain Types in bore sizes 3/16" to 6" Dia. Rod end types in similar size range with externally or internally threaded shanks. Our Engineers welcome an opportunity of studying individual requirements and prescribing a type or types which will serve under your demanding conditions. Southwest can design special types to fit individual specifications. As a result of thorough study of different operating conditions, various steel alloys have been used to meet specific needs. Write for revised Engineering Manual describing complete line. Address Dept. AH-55.

SOUTHWEST PRODUCTS CO.
1705 So. Mountain Ave. • Duarte, California
(LOS ANGELES COUNTY)

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Fill in No. 12 on Reader Service Card

What are the Advantages of Plastics for Air Valves!

If you have been looking for low cost dependability here is a continuous duty direct solenoid valve for 200 psi with full ¼" orifice which costs less than most hand operated valves. The body is machined from tough canvas base phenolic with pipe ports perpendicular to the laminations. No need to baby this valve because the resilient construction will absorb punishment that would damage harder materials.

BACHMAN ¼" 4-Way Solenoid Valve—$12.75

With this unit you can operate, check or cushion an air cylinder. On the oil side of an air-hydraulic system the same valve will provide positive check or dwell. Use it for many combinations of manual and automatic control. It is 7" long, weighs 2 lbs. and mounts in any position. Other models have double solenoid and also hand, foot or mechanical actuation. All have ½" stroke and spring return is optional.

Ask us to send you one of these units for a 30 day test and decide for yourself whether this long life leakproof valve can save you money.

Made and guaranteed by . . .

John D. Bachman & Co.
Bristol, Tennessee

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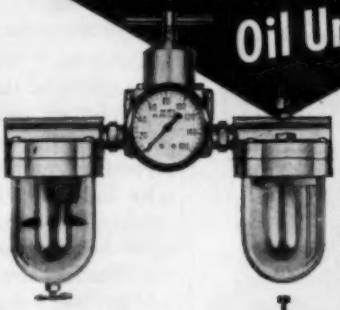
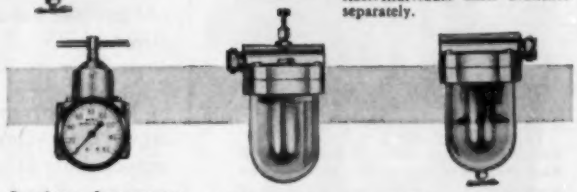
AIR-MITE
FILTER—REGULATOR
Oil Unit

- Instantaneous response to demand
- Special Filter for cleaner air
- Accurate injection of pre-atomized oil



The new AIR-MITE unit is designed and built for maximum operating efficiency, easy maintenance and long life Operates at pressures to 160 psi. Available in ¼", ⅜" and ½" T.P. sizes. Individual units available separately.



Regulator—Incorporates piston cup instead of diaphragm. Provides more accurate, stable regulation, lasts longer. Direct reading gauge for close regulation of outlet pressure.

Lubricator — Automatically pre-atomizes and feeds oil mist into air stream. Simple micro adjustment permits accurate balance of oil-to-air supply.

Filter — Porous sintered bronze element filters better . . . won't collapse . . . is easy to clean. Built in air baffle. Brass drain cock.

Write for catalog sheets and prices.

AIR-MITE Devices, Inc.
4415 W. CARROLL AVENUE • CHICAGO 24, ILLINOIS

UNBRAKO

Self-Locking Cup Point

Prevents this set screw from working loose

Unique counterclockwise knurls prevent these socket set screws from working loose, even in poorly tapped holes. And UNBRAKO Self-Locking Socket Set Screws can be seated tighter than ordinary set screws—as much as 45% tighter. For complete information, see your local UNBRAKO industrial distributor or write STANDARD PRESSED STEEL CO., Jenkintown 2, Pa.

UNBRAKO SOCKET SCREW DIVISION SPS
JENKINTOWN PENNSYLVANIA

HIGH PRESSURE PUMP

air driven
FOR PRESSURES TO 30,000 PSI

Measures 8¼" wide x 9⅜" deep

Boost 100 PSI. air pressure to 10,000 PSI. fluid pressure for $173.25 (FOB Gardena, Calif.). Eight standard models for output fluid pressures of 1,000 to 30,000 PSI. Special models for lower or higher pressures.

Applicable wherever low volume output at high pressures is the requirement. For oil or water service. Complete power packages also available. Send for bulletins.

SPRAGUE
Engineering Corporation
1144 WEST 135TH STREET, GARDENA, CALIFORNIA

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Promet
Engineered Bronze

BEARINGS • BUSHINGS
WEARING PARTS

Stay on the job hours on end with never a doubt. They've got what it takes and can take it!

You needn't take our word for it. Take it from those who know: "We have formed a very high opinion of your products. They have served us well from a standpoint of wear and trouble-free usage. Your service and cooperation in expediting deliveries as required is very commendable."
—One of America's largest tool manufacturers.

"We find your Promet bronze of high quality and excellent in performance for use in our various pump assemblies. Your cast bronzes have excelled in their performance. Castings have also been of good sound quality."
—One of America's leading automotive parts manufacturers.

Write for free literature and service data sheets. Send blueprints, conditions of operation and other data for recommendations and quotations. You are invited to discuss your bearing problems with our metallurgists, engineers, and laboratory technicians.

THE
American Crucible
PRODUCTS CO.

. . . bearing specialists since 1919
1303 Oberlin Avenue
Lorain, Ohio, U. S. A.

Post Scripts of Industry
continued

will also have jurisdiction over the laboratories of the corporation, will supervise an engineering program which uses the services of a staff of more than 7,000 persons. Dr. Hall, who helped organize the Servomechanisms Laboratory at MIT, in 1950 became associate director of the Bendix Research laboratories and in 1952 was appointed technical director.

J. N. Fauver Company, Inc., moved their stocking warehouse and branch from Dayton to 5562 Montgomery Road, Cincinnati, Ohio. T. H. Abbiati is in charge.

G. M. Giannini & Co., Inc. moved their general offices and Instrument Developing Engineering to new, larger quarters at 918 E. Green Street, Pasadena, California.

Acushnet Process Company elected **Richard B. Young** vice-president of the company and general manager of the Rubber Division. Mrs. **Flora M. Stewart** succeeds Young to the position of treasurer.

Richard B. Young
Acushnet Process Company

What he needs is a
STAFFA HYDRAULIC RAM!

Staffa Rams are available in four standard ranges: high and low pressure solid, high pressure hollow and tubby rams. Loads from 1 to 150 tons. Pressures up to 5,000 p.s.i., strokes up to 36". Higher pressure and larger stroke rams are made specially.

For rams, pumps and all other hydraulic equipment write to Chamberlain Industries Ltd. Staffa Works, Staffa Road, Leyton, London, E.10.

Staffa PRODUCTS

CHAMBERLAIN INDUSTRIES LTD.

Staffa Works, Staffa Road,
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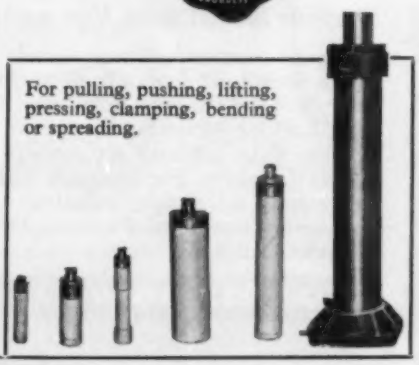
For pulling, pushing, lifting, pressing, clamping, bending or spreading.



A. W. McGuire
National Motor Bearing Co., Inc.

V. L. Peickii
National Motor Bearing Co., Inc.

National Motor Bearing Co., Inc., appointed **A. W. McGuire** as product manager of National O-rings. In his new capacity, McGuire will work with district sales offices in leading cities, specializing in the engineering, application and sales of O-rings. **V. L. Peickii** was named the company's director of research. He will be located at the Redwood City home office and plant.

The Bellows Company established two new sales offices in Birmingham, Alabama and Richmond, Virginia. **Elwood E. Zerbe** and **Henry W. Poburka** were assigned as field engineers to serve Alabama and parts of Virginia. The new offices will be under the direction of **Sidney B. Ehrlich,** Southeast district manager.

The National Industrial Leather Association at its annual meeting elected the following officers for 1955: J. N. Smith, E. F. Houghton Co.; David S. Williams, Graton

Continued on next page

Hydraulic CYLINDERS

to specification

AT your service — since 1918 — the most modern machine tools to handle up to 15" I. D., including the last word in honing equipment and the most accurate of precision gauging equipment. Everything we do is to specification. Expanded facilities permit prompt delivery of 1 or 1000 pieces in any material desired.

Call Erie 2-3664 - Send specifications to

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ninety two pages
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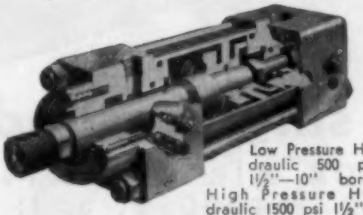
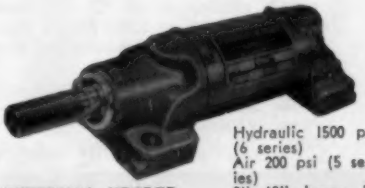
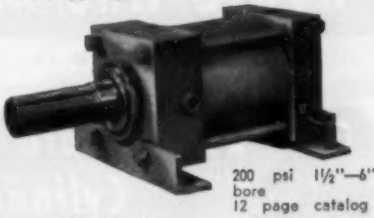
PNEUMATIC
engineering data
and specifications
for the asking....



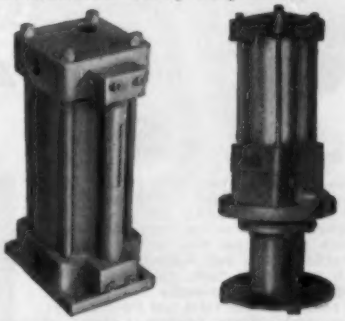
TIE-ROD *Design* ☐
Low Pressure Hydraulic 500 psi 1½"—10" bores
High Pressure Hydraulic 1500 psi 1½"—6" bores
Air 200 psi 1½"—10" bores. 42 page catalog



INTERNAL KEEPER RING *type* ☐
Hydraulic 1500 psi (6 series)
Air 200 psi (5 series)
2"—10" bores. 30 page catalog



AUTOMOTIVE *Heavy Duty Air* ☐
200 psi 1½"—6" bore
12 page catalog



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Boosters, Drive Cylinders 4", 5", 6", 8" bore. Ratios 5:1 to 28.5:1.
Air-Oil Tanks 4"—10" bore sizes. 8 page catalog

Indicate the catalog or catalogs you desire or if you want the complete file ask for 92 pages of Hydraulic-Pneumatic engineering data and specifications.

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- New Series "S" Hydro-Line Cylinders
- 95% efficient at 100 PSI air pressure
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- The standard Automation Cylinder of the Automotive Industry
- Compact, flexible design
- Advanced design of cushions in the Series "S" make it possible to use the full stroke on these cylinders at higher speeds and loads than the conventional type.

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Post Scripts of Industry
continued

& Knight Co.; A. B. Laurence, Laurence Belting Co.; E. R. Rath was re-elected vice-president and secretary. Three new directors to the Association's board are: C. C. Bradbury, C. W. Marsh Company; Lester H. Shingle, The Shingle Leather Co.; David S. Williams, Graton & Knight Co.

Ray E. Fleeson has joined the sales staff of the Chicago district office of the **Tubular Products Division** of The Babcock & Wilcox Company. Fleeson has been associated with B & W since 1933.

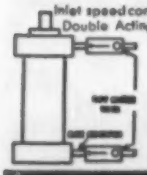
George A. Viane was named Detroit district representative for **Cook Electric Company.** Also announced was the company's new Washington, D. C. office, headed by **William M. Talbot.**

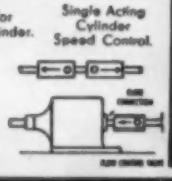
Get Easier, More Accurate Cylinder Speed Control with *Pneu-Trol* VALVES IN AIR OR HYDRAULIC USE

2000 and 5000 (steel) P.S.I.

Pneu-Trol Valves combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control and a floating retro ball check, which permits full flow in the opposite direction. Retro ball floats in most sensitive position to seat, requiring only a slight differential pressure to fully open or close it. Check Valve and Needle Valve incorporate single function features of Flow Control Valve. All valves available in 5 female pipe sizes—⅛" to ¾". Valve bodies are made from brass, aluminum, steel or stainless steel. Attractive Prices—Imediate Delivery.

Write for Illustrated Circular and Price List.





Pneu-Trol Devices, Inc.
1426 N. Keating Ave., Chicago 51, Ill.

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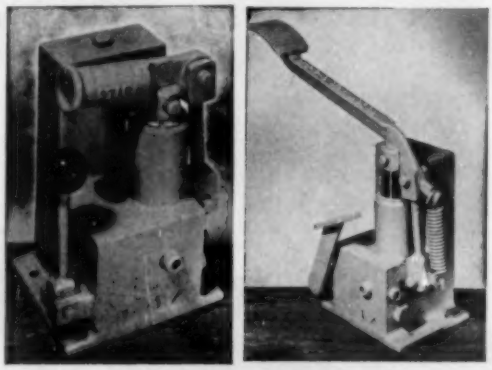
STAR Hi-Lo TWO SPEED CONCENTRIC PUMPS



- **HAND AND FOOT OPERATED**
  Two speed construction provides automatic change over during operating cycle from high speed low pressure to low speed high pressure.
- **MAXIMUM CAPACITY 10,000 P.S.I.**
  Safety overload valves—Hard chrome plated pistons—Piston stroke 1½ inch—Oil capacity 150 cu in or larger—3 models (½"-⅞") (½"-1¼") (½"-1½")

Representative areas available

Star Jack Co. *River Grove, Ill.*

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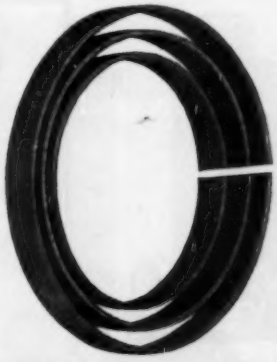
Eastern Industries, Inc., moved into their new plant at Hamden, Conn. A combination home office and manufacturing plant, it provides 28,000 square feet of space to meet the company's growing operations. Located on 5 acres of land, the plant has 30 individual offices, laboratories, drafting and engineering department, a model shop and about 10,000 square feet of manufacturing space. Testing and developing are of utmost importance in the new plant operation. A pressurized engineering laboratory can simulate high altitudes for developing new aircraft components. A geared-to-the-minute research lab, and a model shop for proto-types will aid in further development.

The Trabon Engineering Corporation has appointed **R. E. Kunz Company,** Seattle, Washington, as its distributor covering the state of Washington and the panhandle of Idaho.

Cuno Engineering appointed **R. W. Hagedorn** and **D. M. Gannon** as exclusive sales representatives for their line of industrial filters in the St. Louis, Missouri territory.

Continued on next page

Auto-Diesel
GUIDE RINGS
are
LONG-WEARING!



The Auto-Diesel Guide Ring was especially designed for single acting hydraulic cylinders because they were badly in need of LONG-WEARING GUIDE RINGS. They are made of bronze to give long life. These rings are made in sizes from 2" up to 10" in diameter and in widths from ¼" to 1½". They are priced right and we can make fast delivery. Why not write?

We specialize in QUALITY Piston Rings
1) in SMALL Runs
2) Give FAST Service
3) at ATTRACTIVE Prices

Many firms need piston rings only in small quantities. That is the type of business we specialize in. We are organized to handle small runs efficiently and quickly—at the same time sell at ATTRACTIVE PRICES. Can make up to 35" diameter for original equipment and for replacement in compressors, hydraulic cylinders, valves, etc. Will make circular parts to your specifications. Write for prices.

Write for Details

THE AUTO-DIESEL PISTON RING CO.
3137 Superior Avenue • Cleveland 14, Ohio
"RINGS and SHAPES Since 1921"

FOR SUPERIOR RESISTANCE to ABRASION and CORROSION

Specify STRATOFLEX FLEXIBLE HOSE No. 225

Built to give long service where conditions are especially rough on hose lines. Reinforced with high tensile strength wire braid with outer cover of tough synthetic rubber. In bulk Hose or Hose Assemblies with Stratoflex "over the cover" detachable, re-usable fittings. Write for your FREE catalog or order through your dealer.

★ Hose Assemblies
★ Re-usable Hose Fittings

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STRATOFLEX, Inc., FORT WORTH, TEXAS
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Capable of development of diversified equipments and components for industrial and military use.

Secure positions, excellent working conditions, opportunities for advancement.

RAYTHEON

Excellence in Electronics

Write: RAYTHEON MFG. CO.
Attn. Mr. A. H. Nile
190 Willow Street, Waltham, Mass.

Post Scripts of Industry
continued

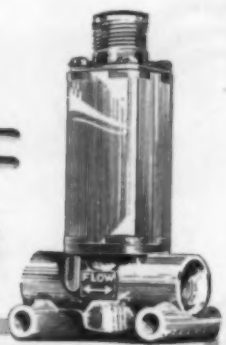
Flexonics Corporation assigned **Frank C. Hesterman** to the position of technical staff assistant in the production department, and **E. L. Hiter** has become sales manager of the company's Expansion Joint Division. Since 1952 Hiter served as western manager with headquarters in San Francisco and Los Angeles.

Powermatic Sales Company appointed **Alvin F. Tinker** director of sales. Tinker was associated with the machinery business for a number of years.

Ledeen Manufacturing Co., appointed **Unisco, Inc.,** New York City, as distributors for southeastern New York, including New York City and Long Island, and northeastern Pennsylvania.

Charles E. Dietzel was named sales manager of the **International**

MAXIMUM
FLOW
=
MINIMUM
WEIGHT



New Valcor Solenoid Valves . . . with the highest ratio of flow to weight of any Valve made. They are low in weight; low in pressure drop; low in power consumption; . . . and low in cost. No other Solenoid Valve but VALCOR is so completely depended upon in so many critical applications

SPECIFICATIONS:
Weight—1/3 lbs.
Ambient Temperature—minus 65° to plus 180° F.
Max. Leakage—½ cc/hr. fuel 10 cc/min. air
Current Drain — ½ amperes @ 24 V.D.C. Designed in accordance with MIL-V-8610 (ASG) and MIL-E-5009A

Valcor Valve Part No.	Type	Max. Operating Pressure
V-3800	Normally Open	200 psig
V-3900	Normally Closed	100 psig
V-6800	Normally Open	300 psig
V-8400	Normally Closed	200 psig
V-8500	Normally Open	300 psig
V-5000	Normally Closed	300 psig
V-8300	Normally Open	500 psig
V-7000	Normally Closed	500 psig

Write today for detailed information

VALCOR
SOLENOID VALVES

Eastern Representative: East Coast Engineering Co. Roslyn Professional Bldg., Roslyn, N. Y.
Western Representative: Rowe Sales Co. 2140 Westwood Blvd., Los Angeles 25, Calif.

VALCOR ENGINEERING CORP.
CARNEGIE AVE., KENILWORTH, N. J.

Is Delivery A Problem?

WE HAVE HYDRAULIC POWER ON THE SHELF

Our inventory includes a wide variety of pumps, valves and controls to satisfy your needs immediately. Pumps from 1000-3000 PSI 1½—100 G P M. 4 - way valves, ⅛—3 NPT relief valves, check valves, to complete any circuit in a hurry. JIC standard 20-30-60 gallon tanks in stock.

Package power units designed for your specific needs in accordance with JIC standards.

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Write for Free Catalog Today!

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Packings Corporation, subsidiary of the Graton & Knight Company. He was formerly district manager for both companies in Arkansas, Kentucky, western Tennessee, northern Louisiana and Mississippi.

Charles E. Dietzel
International Packings Corp.

Minneapolis-Honeywell Regulator Company purchased the assets of **Heiland Research Corporation,** Denver, manufacturers of precision scientific instruments. The firm will be operated as a new Honeywell division. **Stephen A. Keller** has been named general manager of this new division, which will continue to operate from its Denver plant and offices, with the present production, administrative and sales personnel. **Marshall B. Taft** was appointed general manager of the company's Valve Division.

Accessory Products Corporation opened a new modern addition to its Whittier plant, adding 9000 square feet to the existing space. The increased facilities were specifically designed for the manufacture and testing of the company's aircraft products.

Appointments of administrative and staff personnel of **The Texas Company's** research and technical department were announced by Frederic H. Holmes, vice president in charge of this new department. **Dr. Wayne E. Kuhn** is general manager, **W. A. McMillan,** assistant general manager and **Gus Kaufman,** manager (operations). Appointments in the research division

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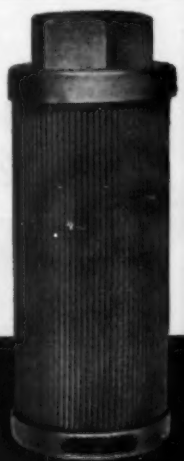
★MEETS J.I.C. STANDARDS
★GREATER FILTERING AREA
★SPECIAL TRAP-WEAVE MESH



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CAPITAL HYDRAULIC OIL FILTER
WITH MONEL METAL INSERT
Reservoir Type for Hydraulic and Oil Re-Circulating Machinery
EASY TO INSTALL • EASY TO CLEAN • LONG LIFE • LOW COST
SIZES AND SCREENS TO FIT YOUR NEEDS

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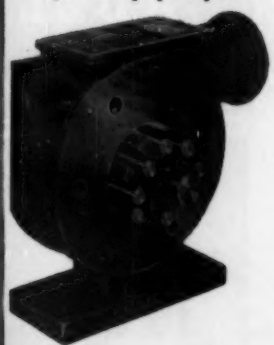
EQUIPMENT FOR FLUID POWER TRANSMISSION

Primary Oil Pumps • Vacuum Powered Transmission and Low Pressure Air Service • Air and Liquid Filters •

What's your problem?

- higher pumping speeds?
- tolerance of particle-laden liquids?
- peak suction for primary pumps?



the Kraissl-50 Roller Pump

is unmatched for dependable performance on every one of these counts.

Bulletin A-1330 has full data . . . write for it. The roller-rotor design easily handles particles that would jam more tightly-fitted mechanisms—reduces cavitation, allowing higher speed operation*—develops high suction characteristics.

**Roller mechanisms permit higher speeds with any oil than most displacement designs.*

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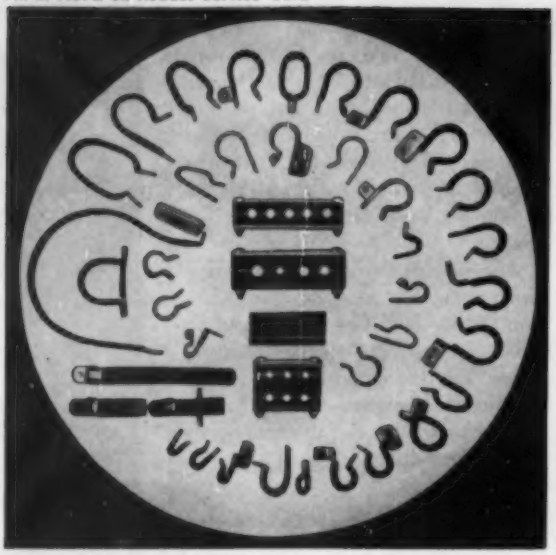

15,000 different types and sizes of LINE SUPPORT CLIPS, LINE SUPPORT BLOCKS and HARNESS STRAPS for positive, vibration-free support in aircraft, marine and industrial installations.

Consider the advantages of standardization — *completeness of line — a smaller and more flexible inventory — quick and easy training of personnel — safety — durability — interchangeability* — ECONOMY ... *Specify ADEL*

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Post Scripts of Industry
continued

are **W. J. Coppoc,** manager of research, **T. C. Heisig,** assistant manager of research (products), and **C. E. Moser,** assistant manager of research (process). The Texas Company also, announced these new assignments in its technical services division: **R. W. Hall,** manager of technical services, **A. L. Brodie,** assistant manager (automotive), **M. L. Langworthy,** assistant manager (manufacturers' service), and **R. R. Thurston,** assistant manager (industrial products).

ACEC Electric Corporation, formerly Belgian Electric Sales Corp., announced its change of name. Under its new policy the line of motors carried by the company's nation wide sales and service organization has been extended to include large horsepower motors as well as single phase motors.

Servomechanisms, Inc., named **Robert Tate** sales and service manager of its eastern Division.

IT COSTS LESS TO USE THE BEST!

PLS

1. Takes less PLS to give a perfect seal.

2. One compound for many services: water...oil...gas...steam...chemicals...petroleum products—low and high pressures.

3. Never washes out—one application lasts forever.

4. Never hardens: joints may be easily broken after years of service—no damaged connections.

For your convenience: available in handy 1-lb. brush top cans.

Prove it to yourself. Send for a free sample. Crane Packing Company, 1805 Cuyler Avenue, Chicago 13, Ill.

JOHN CRANE CRANE PACKING COMPANY

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a manual
SHUT-OFF VALVE
that doesn't leak

- "O" Ring seal for dead tight shutoff
- 416 Stainless barstock body
- Liquid or gas service to 3000 psi
- Design permits throttling

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OTHER CIRCLE SEAL VALVES
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CIRCLE SEAL *precision valves*

Representatives in Principal Cities.

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The Market Place

POSITION WANTED

Pump engineer, 12 years experience, recently engaged in development of high performance piston type transmission, desires responsible position with progressive manufacturer. Box 2155 APPLIED HYDRAULICS.

PUMP FOR SALE

Worthington 1 x 4 single-acting vertical triplex pump—type "VTE" and 30 hp 220/440 volts—3 phase—squirrel-cage motor mounted on 7" x 8" I beams, complete with 10 "V" belts & pulleys, Clark controllers magnetic starter, push button station—brand new, never used. Substantial savings. Contact: Hydramotive, Inc., 6723 Denison Avenue, Cleveland 2, Ohio. Telephone: WOodbine 1-0653.

WANTED: DESIGN AND DEVELOPMENT ENGINEER

with experience in rotary positive displacement pumps by well known progressive midwest manufacturer. Exceptional opportunity for young man with degree in Mechanical Engineering and design experience. Box 2255 APPLIED HYDRAULICS.

DISTRIBUTORS WANTED

Distributors or representatives for several open territories on our line of quality valves, cylinders, valve actuators and pumps. Write giving lines handled and territory covered. Ledeen Mfg. Co., 1600 So. San Pedro St., Los Angeles 15, California.

FITTINGS FOR SALE

Have 340—¾"—45° street elbows, male to female pipe thread, steel, 5000 pounds service plated QQP-416-type-2—class B. Will sell at a discount. Box 2355 APPLIED HYDRAULICS.

POSITION WANTED

Hydraulic engineer desirous of position with Mid-western firm, either in sales or engineering. 12 years diversified experience in sales, service and engineering. Resume on request. Box 2455 APPLIED HYDRAULICS.

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for complete Nationally-advertised line of Air, Hydraulic Cylinders, Valves, Packaged Devices, by established Western manufacturer. Territories open in Southeastern, South Central, Intermountain and Northwestern States, Indianapolis area and East Texas. Fluid power sales experience preferred. For details of profitable, long range plan write Box 2555 APPLIED HYDRAULICS.

DESIGN ENGINEERS

For design and development work on Aircraft Hydraulic Valves. Qualifications desired: B.S. degree in Engineering; at least 8 years engineering experience including 3 years in hydraulics; ability to work efficiently without close supervision.

Salary $7,500—$9,000

An exceptional opportunity with a well-established concern. Send resume to

AIRCRAFT PRODUCTS COMPANY
BRIDGEPORT, PENNA.

ELECTRICIAN WANTED

Excellent opportunity in small rolling mill for man with thorough DC rolling mill experience. Give full details regarding education, experience and desired income. Reply Box 2655 APPLIED HYDRAULICS.

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He won a big award
In the APPLIED HYDRAULICS contest

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Anyone who uses, designs, builds or maintains pneumatic or hydraulic machines or equipment can enter this contest.

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1st PRIZE	2nd PRIZE	3rd PRIZE
$500	$300	$200

. . . and 4th thru 7th prizes are $50 each. Also, all other papers judged as meriting publication will be paid for and published in APPLIED HYDRAULICS.

HERE'S HOW TO ENTER:

WRITE US FOR AN ENTRY BLANK.

Along with suggestions to help prepare your article, we'll send you a reprint of last year's First Prize Paper. To win a cash award, your article must be mailed by June 1st, 1955.

Write today for your entry blank

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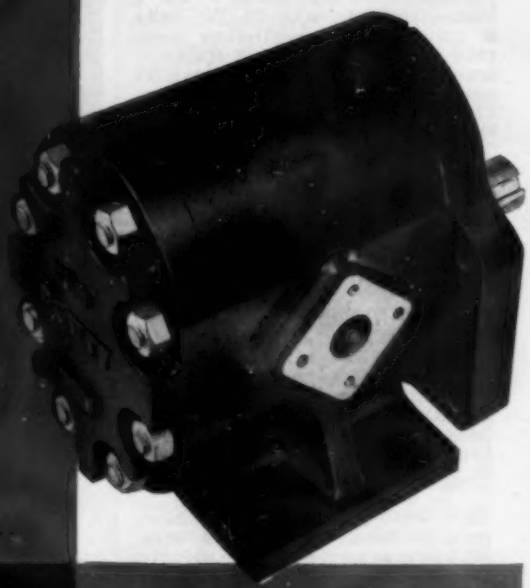
These high pressure gear pumps have made hydraulic operation more accessible to the wide fields of industry. British designed, with British and overseas patents pending, they provide the vital source of hydraulic power at low cost.

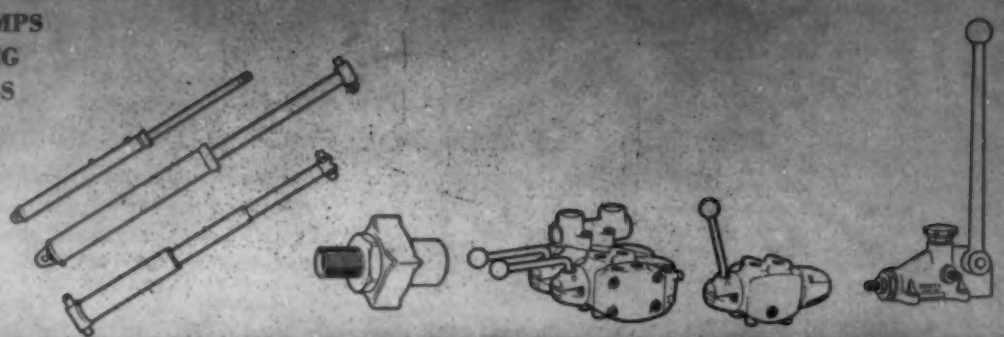


DOWTY
PRESSURE BALANCED
gear pumps

CAPACITIES
from 1 to 50 galls./min.
PRESSURES
up to 2,500 lb./sq.in.
VOLUMETRIC EFFICIENCY — 94%

Broadening the application of hydraulic power:—

DOWTY PUMPS
SELF-SEALING COUPLINGS
CONTROL VALVES
HYDRAULIC RAMS



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Member of the DOWTY Group

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Piston Style, Double Acting
BHEW Hydraulic Cylinder

OPTIONAL MOUNTINGS

It's easy and practical to use BHEW hydraulic cylinders in your applications. Accurately honed barrels, hard chrome-plated rods, small O. D. and any type mounting desired are BHEW cylinder features. All types and sizes available in standard and special O. E. M. designs. BHEW makes single and double acting, high and low pressure cylinders with cup-type, ring-type or O-ring construction. Send specifications of your requirements.

BHEW

Pressure Operated Hydraulic Flow Control Valves, for lift trucks, eliminate surge as load starts down. Load weight controls rate of descent, full speed raising and empty fork travel. Write for details.

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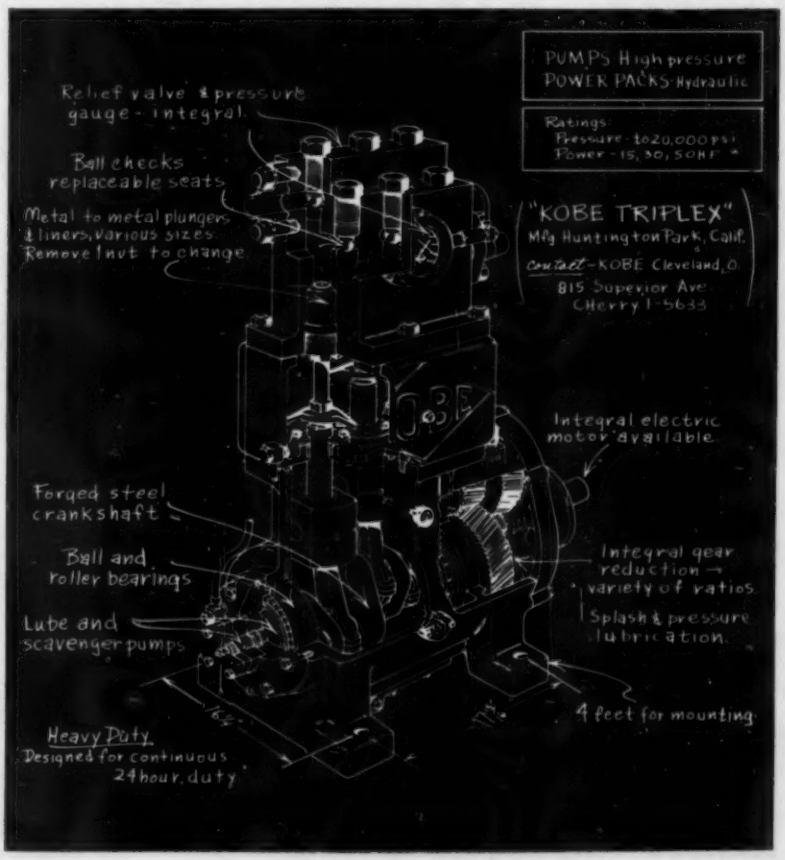
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POWER PACKS Hydraulic
Ratings
Pressure - to 20,000 psi
Power - 15, 30, 50 HP
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Contact - KOBE Cleveland, O.
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Ball checks replaceable seats
Metal to metal plungers & liners, various sizes
Remove 1 nut to change
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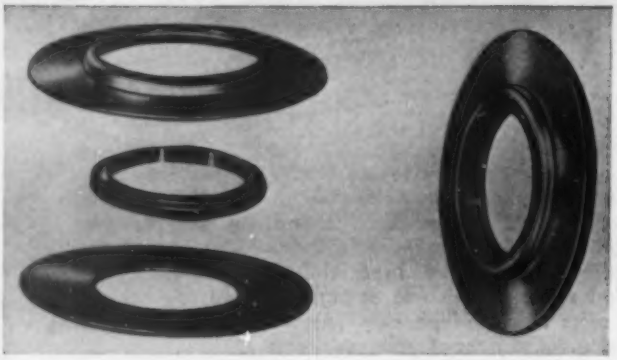
Forged steel crankshaft
Ball and roller bearings
Integral gear reduction → variety of ratios
Lube and scavenger pumps
Splash & pressure lubrication
4 feet for mounting
Heavy Duty
Designed for continuous 24 hour duty

Introducing!!
Hydro-Wype Adapters



For "On The Job Installation" of HYDRO-WYPE SCRAPER RINGS

In response to the overwhelming demand, our engineering department has now developed the Hydro-Wype Scraper Ring Adapter. This universal method of installing Hydro-Wype Scraper Rings makes it possible to easily attach Hydro-Wype Scraper Rings to original, as well as existing equipment, by the use of sheet metal or machine screws.

Simple . . . As A-B-C

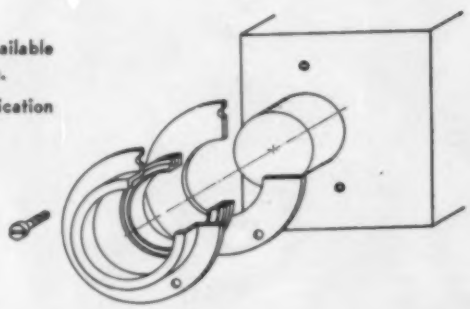
A Drill clearance holes in the mounting rim of the Adapter Set; to match those placed in the mating parts of the cylinder end cap, bushing or mounting plate, as shown in the figure below.

B The Hydro-Wype Scraper Ring is then placed between the front retainer and back plate of the Adapter.

C The Adapter is now fastened to the equipment with mounting screws.

★ Hydro-Wypes available 5/16" to 30" Dia.

★ Approved Specification MIL-S-5049.



For additional details contact your Hydro-Wype Representative

. . . or write to

atsco

1926 East Siebenthaler Ave.
Dayton 4, Ohio

Nation wide sales & service representatives for

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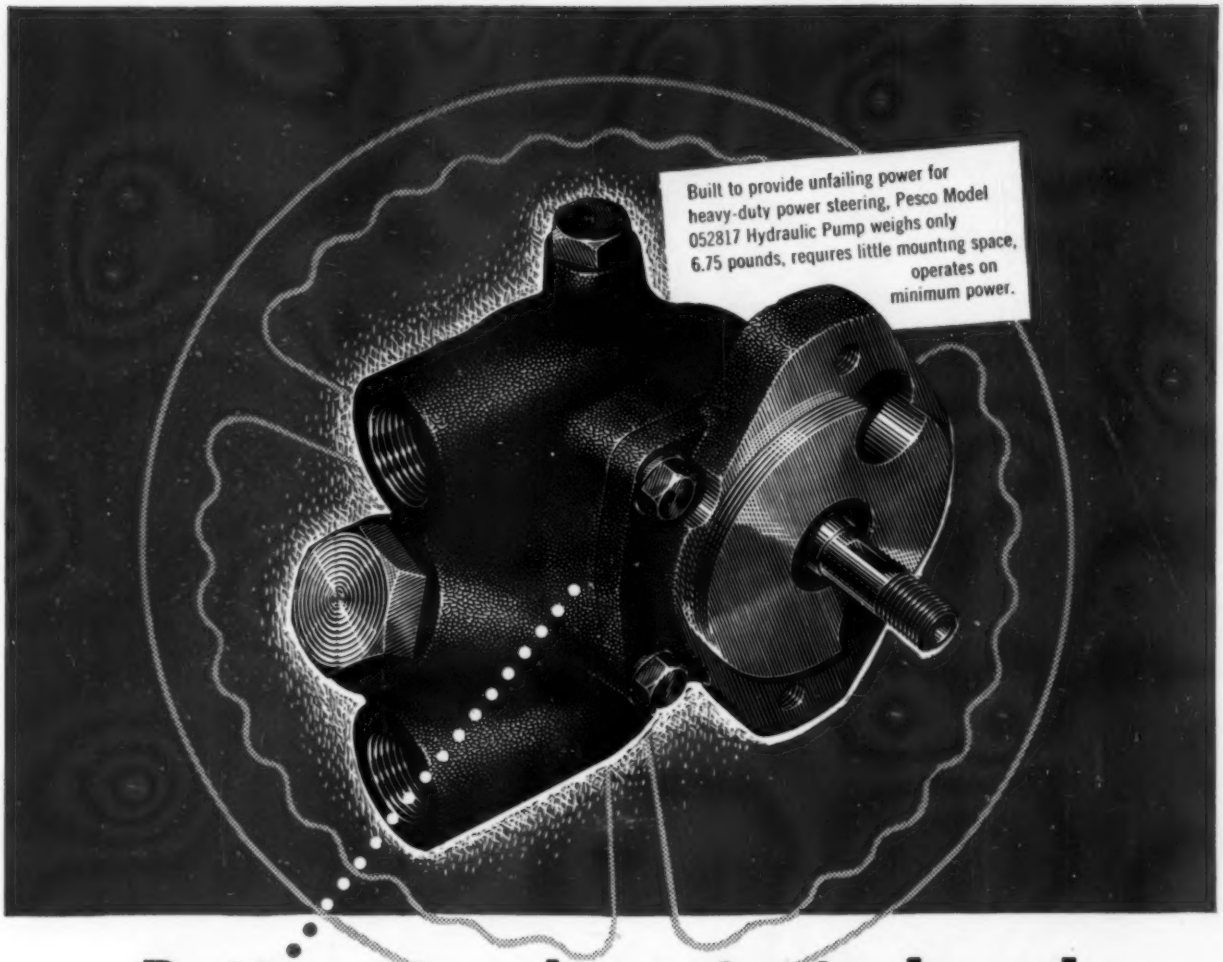
Built to provide unfailing power for heavy-duty power steering, Pesco Model 052817 Hydraulic Pump weighs only 6.75 pounds, requires little mounting space, operates on minimum power.

Better steering starts here!

Improved power steering for all types of heavy-duty vehicles, both over-the-road and off-the-road units, starts with Pesco's Hydraulic Steering Pump. On trucks, tractors and construction equipment, this Pesco-designed pump provides unfaltering hydraulic power regardless of operating conditions.

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Pesco creative engineering produced this pump—and it can produce a pump designed for your exact needs. The experience and "know-how" of Pesco engineers may produce a better and more profitable answer to your hydraulic power problem. This engineering service is available to you . . . and we think you will like the results you get.

Pesco engineers will be glad to supply complete technical information. Operating models are available for testing on your equipment. Call or write: PESCO, 24700 North Miles Road, Bedford, Ohio.

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